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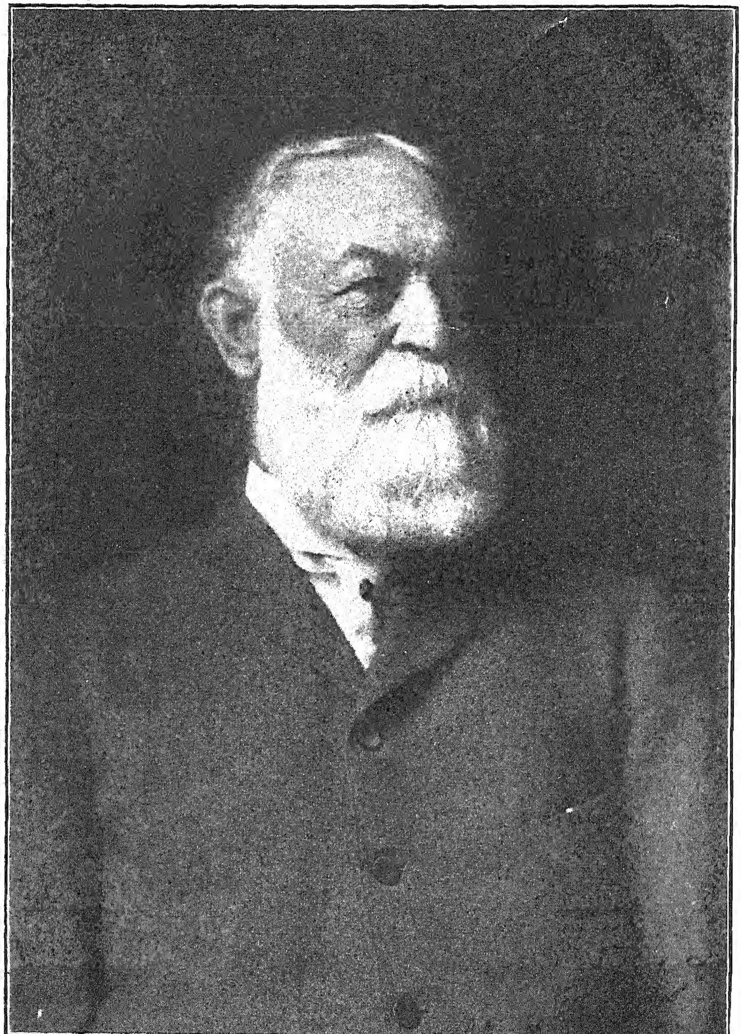

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NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

New species of Micro-Lepidoptera are accumulating so rapidly that it seems a necessity to get them described and labelled in order to properly t..ke care of them. This is especially so in the case of species named for correspondents, and to overcome the objection of having numbers of *MS.* names in collections.

Enarmonia Youngana, sp. nov.—Expanse, 8 to 11 mm.

Head smoky-black, scales with a metallic reflection, tips paler. Palpi yellowish-gray. Antennæ dark brown, obscurely annulated with shining yellow. Thorax blackish-brown, minutely dotted with metallic. Abdomen black, dotted with golden metallic scales.

Fore wing shining bronzy-brown; crossed at middle by a pair of shining bluish-white fasciæ, and similar pair in the outer third of wing.

The inner half of the dark basal area is heavily overlaid with the bluish-white metallic scales. There are three pairs of white costal spots, followed by a single one before the apex. The inner pair at inner third are the beginning of the first pair of metallic fasciæ, which curve outwardly to middle of wing, then drop directly to dorsal margin, where they are very much wider. The second pair of white costal spots are just beyond the middle, and from the two of them a single streak of blue-metallic runs, outwardly oblique, to the middle of the wing. The third pair of white costal spots are in outer fourth, and from each a blue-metallic fascia proceeds, outwardly oblique, to middle of wing, thence angles inward nearly to but not reaching dorsum at angle; between the two is a black ocellic spot, divided by three lines of golden scales into four horizontal bars; opposite the ocellic spot and on inner side of this fascia is a similar velvety-black spot. From the seventh white costal spot is a short spur of metallic-blue defining a lunate yellowish-white apical spot.

Beyond the middle of the wing the dark ground colour is overlaid with vertical wavy rows of golden-yellow scales. The three outer costal spots are each marked in the centre by a tiny black point. A line of black

scales defines the apex and outer margin, and is interrupted by two yellow dashes above the middle and a broader one just above anal angle. Cilia leaden-metallic.

Hind wing smoky-brown, cilia bleached straw colour. Under side fore wing leaden-brown, with the costal spots and black terminal line repeated.

Nine specimens, bred by Mr. C. H. Young, at Hurdman's Bridge, Ottawa, Canada. Dr. Fletcher informs me that the larvæ are found during the winter in the centre of the cones of White Spruce, *Picea alba*, the moths emerging in the ensuing spring.

Co-types in collections of Fletcher, Young and Kearfott.

Venation: Fore wing, all veins separate, outer margin straight, but very much oblique. Hind wing, 3 and 4 stalked, 5 approximate to 4; 6 and 7 very close at base.

Named in honour of Mr. Young, whose industry and perseverance in working out obscure life-histories of insects, in many cases of extreme economic importance, is of the greatest scientific value.

Epagoge lycopodiana, sp. nov.—Expanse, 13 to 16 mm.

Head, palpi, thorax ochreous-yellow. Palpi outwardly shaded with red, a streak of the same colour on each side of the thorax and at base of patagia. Antennæ reddish-yellow at base, becoming smoky-fuscous beyond. Abdomen smoky-fuscous, anal tuft yellowish. Legs pale ochreous, dusty with smoky-brown.

Fore wing ochreous-yellow, evenly mottled with red. A deep Indian-red fascia begins at costa, between third and middle, and goes obliquely to outer third of dorsum, where it joins a similar fascia, which runs obliquely outward to end of cell. From the costa at outer fourth a line of deep red scales curves outwardly to the anal angle; beyond this is a short fascia from costa, just before apex, ending in middle of wing, and paralleling upper half of termen. These fasciæ are overlaid with shining bluish scales. In some specimens the deep Indian-red colour almost covers the entire outer part of the wing, from the inner fascia, and in these dark specimens there is only a small patch of the ground colour above the end of cell, on the costa, with a slight shading of yellow before the anal angle. Cilia ochreous-yellow.

Hind wing very dark smoky fuscous; cilia metallic-fuscous, under side leaden black.

Under side fore wing reddish-black, with a yellowish spot above end of cell; extreme costal edge and cilia reddish-yellow.

Twelve specimens, bred by Mr. C. H. Young, from larvæ feeding in Club Moss, *Lycopodium*, at Hurdman's Bridge, Ottawa, Canada.

Co-types in collections of Fletcher, Young and Kearfott.

This species is very like *Epagoge sulfureana*, Clem., and I have held it for over two years, thinking it possibly might be a variety. I have examples of the latter from nearly all of the Gulf and Eastern States, and while they exhibit a very wide range of variability, there is not one that even approximates this intensely-dark form. It is nearer *E. tunicana*, Wlsm., but is a brighter red.

Venation: Fore wing, 7 and 8 stalked, others separate; hind wing, 3 and 4 approximate, but not connate, 6 and 7 connate, not stalked. In Meyrick's Handbook of British Lepidoptera, the synopsis of this genus states that 3 and 4 of hind wing are connate, and 6 and 7 stalked.

Recurvaria coniferella, sp. nov.—Expanse, 9 mm.

Head opalescent-white, palpi pale cinereous, third joint ringed with black at base and tip. Antennæ whitish, annulated with brown. Abdomen and legs pale cinereous, the latter heavily ringed with black.

Fore wing yellowish-white or pale cinereous, overlaid with white in the middle of the wing from base to end of cell, and above the fold. There are the usnal three oblique fasciæ, all much broken into spots. The inner consists of a black dot on costa at base, and tuft of black and white raised scales below the fold at inner fifth. The second consists of a black dot on costa before the middle, hardly separated from a larger dot below it on the middle of the wing; below this is a third distinctly separated dot above the dorsum. The outer fascia begins in outer third of costa, with a large dot; below it, towards base, is a small round dot, and another towards apex in the form of a short horizontal line; below the first of these, above the dorsum, is another small dot. All of these dots, except on the costa, consist of tufts of black raised scales, bounded outwardly with white raised scales. The apex of wing is heavily powdered with black, obscurely forming four black marginal dots. Cilia gray, overlaid with black.

Hind wing pale gray, cilia yellowish-gray.

Two specimens, bred from larvæ on pine, Ottawa, Canada, by Mr. Arthur Gibson. Issued June 20, 1905. Type in my collection. Co-type in Dr. Fletcher's collection.

In general appearance this species most nearly resembles *R. apicitripunctella*, Clem., the larvæ of which are common on hemlock. *Coniferella* is smaller, the arrangement of spots different, and is a very much darker species.

Recurvaria Gibsonella, sp. nov.—Expanse, 11 mm.

Head opalescent-white, palpi whitish, clouded with light brown on inner sides of second joint, outer joint black, with a narrow white ring at base, a broader one in the middle and a tiny point of white at apex. Antennæ whitish, annulated with dark brown. Thorax whitish-yellow, overlaid with black and brown. Abdomen opalescent-white and brown. Legs yellowish-white, heavily ringed with black.

Fore wing white, shaded with yellowish on apex and crossed by three broad oblique dark brown bands. The inner from costa at base, continuing to below the fold, but not reaching dorsal margin. The second from inner third at costa, broadens at the middle and sends a long spur into the outer fascia. The outer begins on costa at outer fourth, and is the broadest of the three; it recurves inwardly to dorsum. The apex and outer margin are dark brown, enclosing an anti-marginal white spot, which is divided by a streak of dark scales. The usual tufts of raised scales occur on the dorsal half of the three dark fasciæ. Cilia yellowish-white, heavily overlaid with black.

Hind wing yellowish-gray, cilia the same.

Three specimens, bred from larvæ on *Juniperus communis*, by Mr. Arthur Gibson, Ottawa, Canada. Types in my collection, co-types in Dr. Fletcher's collection.

This species is not at all like the specimens I have bred from the same food-plant in New Jersey, and described in the Journal of the New York Entomological Society, September, 1903, but more nearly resembles the two species bred from Spruce and Arbor-vitæ.

Recurvaria obscurella, new name.—I propose this name in place of var. *nigra*, Jour. N. Y. Ent. Soc. XI., 1903, p. 156, as the latter is preoccupied.

Symphysa simplicialis, sp. nov.—Expanse, 11 to 15 mm.

Labial palpi upturned, second joint tufted in front, third joint acuminate; maxillary palpi short, filiform, both pale cream colour, the former clouded with brownish on outside of second and third joints. Tongue long, concealed by well-developed tufts of creamy-white scales.

Antennæ slightly serrate, cream colour at base, outer joints annulated with grayish-fuscous. Thorax grayish-white. Abdomen fuscous and tuft cream-white. Legs cream white, minutely dotted with brown. Tarsi annulated with brown.

Fore wing dark gray, minutely dotted with blackish-gray, a darker shade across the wing at inner third, a short, narrow, outwardly oblique curved line from middle of costa to upper edge of cell, a similar fine white ante-terminal line from costa beyond outer fourth, curving under apex and down to dorsal margin, just before anal angle, slightly indented at lower third. A blackish preciliate line interrupted by the veins. Cilia paler.

Hind wing pale fuscous, thickly dotted with black scales along dorsal and outer margins. An obscure whitish ante-terminal line, strongest towards dorsal margin; slightly indented at upper third.

Under side, both wings shining pale gray, the white lines faintly repeated.

Two ♂ specimens, collected by Professor F. H. Snow, one Brownsville, Texas, June, and one San Bernardino Ranch, Cochise Co., Arizona, 3,750 feet elevation, August.

One type in collection of Kansas Academy Sciences, and one in my collection.

Differs from *renicularis*, Zell., in the absence of white discal spots, and from both *renicularis* and *eripalis*, Grote, in the outer white lines of both wings being very much closer to the outer margin.

Prionapteryx baboquivariella, sp. nov.—Expanse, 22 to 28 mm.

Head, palpi and thorax sordid white. Scales of outer joint of labial palpi leaden-gray, of maxillary palpi cinnamon-brown; thorax heavily overlaid with brown, and much darker than the collar and patagia. Abdomen and anal tuft creamy-white. Legs creamy-white. Anterior tibiæ dotted with brown. All tarsi annulated with the same colour.

Fore wing pale olivaceous-brown, with the lower median vein and the veins in the outer third of wing overlaid with white, below the white median vein is a much darker brown streak from base to anal angle, and a dark streak above it from base to end of cell. The outer half of costa is shaded with white, through which run four outwardly-oblique brown lines, the inner, at end of cell, runs into the brown lines above and below the median vein, forming an obscure dark dentate transverse line; a similar preciliate line of white from costa, outwardly oblique for one-third the width of wing, thence inwardly oblique to a third above dorsal margin,

thence obscurely dentate to margin, is inwardly outlined with darker brown; a short white line from costa at apex to termen. In the middle of the outer margin is a small white ocellic dot, just below the incision, above is a short dark bar, and before it the ground colour is heavily sprinkled with darker scales. Cilia sordid white, divided by a brown line above the incision. Hind wings pale cinereous, with a darker shade before the cilia, which are sordid white, with a slightly darker basal line.

Five specimens, four collected by Prof. F. H. Snow, Baboquivaria Mountains, Arizona, and one Huachuca Mountains, Arizona, O. C. Poling. Co-types in Kansas Academy of Sciences and my collection.

Nearest to *achatina*, Zell., but can be readily separated by the two fine white lines on costa just before apex, which are lacking in *achatina*, and in their place is a rather broad white streak. The four specimens from Prof. Snow are rather badly rubbed, especially over the middle of the wing, causing an impression of a broad white median band.

Plutella yumaella, sp. nov.—Expanse, 16 to 27 mm.

Head with loose scales; antennæ simple, basal joint with dense flaps; labial palpi, second joint with short dense tuft above appressed to face, third joint short, obtuse; both head, palpi and thorax grayish-white, mixed with black scales, patagia tipped with ochreous scales, posterior thoracic tuft white, stained at the ends with ochreous.

Fore wing elongate ovate, whitish-gray, mottled with black. The basal area to one-fourth on costa and one-third on dorsal margin is heavily mottled with black, beyond is a narrow oblique whitish fascia, beyond this the wing is heavily mottled, but interrupted on upper half by a crescent-shaped whitish fascia, which leaves costa at middle and regains it at outer fourth; the apical fifth is whitish, less overlaid with black. Cilia whitish-gray, speckled with black.

Hind wing and under side of both wings cinereous. Abdomen cinereous, with a tuft of ochreous scales on each side on the middle segments, anal tuft dark ochreous. Legs cinereous, anterior and middle and tarsi of posterior legs heavily speckled with black.

Two specimens, San Bernardino Ranch, Cochise Co., Ariz., 3,750 feet elevation, August (F. H. Snow). One, Brownsville, Texas, June (F. H. Snow). One, Gila Co., Ariz., June (O. C. Poling). One, Baboquivaria Mts., Pima Co., Ariz., July 15-30 (O. C. Poling). Two, So. Arizona (Poling). Nine specimens, Yuma Co., Arizona Desert, received from J. B. Smith.

Types: University of Kansas and my collection.

Placed in *Plutella* tentatively; agrees with Meyrick's definition, except that 3 and 4 hind wings are not approximate, the palpi are tufted above and not beneath.

Genus DOROTA, Busck.

The moths of this genus superficially resemble Crambids, on account of their long, extended labial palpi; so far they have only been taken in Arizona and California, and only a very few specimens are known.

I have a fine specimen of *lineata*, Wlsm. (*virgatella*, Busck), from Cochise Co., Ariz., June 4, 1904, from Geo. Franck, and two very distinctly marked species, which are described below. The four known species can be separated by the following table:

Fore wing with lighter median streak .... 1.
Fore wing without lighter median streak .... 2.
1. Ground colour light ochreous-brown .... = medioliniella.
Ground colour ashy-gray .... = albastrigulella.
2. Fore wing marked with darker lines .... = lineata.
Fore wing not marked with darker lines .... = inorratella.

Dorota medioliniella, sp. nov.—♀. Expanse, 27 mm.

Palpi, head and thorax pale yellowish-brown, speckled with gray-brown; palpi long, about 4 mm., porrect, outer joint sharply bent downward.

Fore wing 3½ times as long as broad, lanceolate, pale yellowish-brown, a paler creamy-white streak from base to apex, interrupted at end of cell with a few dark scales, with a darker geminate-blackish streak above it. A slightly darker shade above dorsal margin, and a cluster of dark scales on fold at inner third.

A number of black dots are scattered over the wing, notably a line of eight on inner half close to costa, becoming more widely separated outwardly, one on upper edge of dark streak near apex, about eight in pale streak, about fifteen in three irregular horizontal rows on outer third below middle, four of which are in the cilia, a line of six in two groups of three above fold in middle of wing and one above the fold. Extreme dorsal edge dotted with brown scales.

Hind wing, fuscous-gray, slightly shining, cilia same. Under side both wings fuscous-gray, with a brassy tinge. Abdomen same, anal tuft paler. Legs cream-white.

One specimen, Claremont, Cal. No. 3889. C. F. Baker. Type in my collection.

Dorota albastrigulella, sp. nov.—♂. Expanse, 21 mm.

Palpi, head, thorax and fore wing fuscous, strigulated with pure white. Palpi porrect, 2.5 mm. long, outer joint not drooping, but bent outward, at an angle of about fifteen degrees, the brush from second joint extends as far as apex of third, but is porrect, and with the diverging outer joint forms a Y at end of each palpus. The white strigulations of fore wing are most heavily laid between one-third below costa and one-third above dorsal margin, but hardly in a well-defined streak; towards the apical margin some of the veins are bare of white scales, forming short, ill-defined dark streaks. A dark dot at end of cell and another at inner fourth, both about the middle of wing. Cilia white, divided by a fuscous line. Hind wing fuscous-gray, darker before cilia. Under side, both wings dark fuscous-gray. Abdomen the same, anal tuft paler. Legs yellowish-white.

One specimen, Placer Co., Cal., June 1, 1904. Arthur H. Vachell. Type in my collection.

Holcocera Arizoniella, sp. nov.—Expanse, 15 to 18 mm.

Head, palpi, antennæ, thorax, abdomen, legs and fore wings creamy white; hind wing shining gray-white, cilia cream-white, anal tuft ochreous-white.

Three specimens, San Bernardino Ranch, Cochise Co., Arizona, 3,750 feet elevation, August (F. H. Snow). Twelve specimens, Phœnix and Globe, Arizona, August and October (Kunzé).

Types in University of Kansas and my collection.

Incurvaria Taylorella, sp. nov.—Expanse, 16 mm.

Head hairy, pale straw-colour, darker above; palpi same, with a few burnished scales on outside; abdomen yellowish-white; legs the same colour, but annulated with burnished scales; antennæ pale-straw colour.

Fore wing burnished purple, with a coppery reflection, with four pale yellow spots; a triangular spot on outer third of costa, pointed on its lower end, which extends a trifle more than a third across wing, curved obliquely inwards; below this, on dorsal margin, a nearly square spot, extending upwards a third of the width of wing, and separated by the spot above it by a trifle less than one-third; a larger dorsal spot at inner fourth broadest on dorsal margin, convex on its outer and concave on its inner edge, extends obliquely to within one-third of costa; a spot in the apex with a spur running down through the cilia of the termen nearly to the anal angle.

Hind wings fuscous, with a purplish reflection. Under side of both

wings same as upper, but lighter in colour, the spots of the fore wing faintly repeated.

Two ♀ specimens, Wellington, B. C., May 15, Rev. Geo. W. Taylor; Mt. Washington, N. H., Mrs. A. T. Slosson.

Types in Mrs. Slosson's and my collections.

Closest to *capitella*, Clerck (Europe), which differs in the inner dorsal spot extending entirely across the wing; the outer spots approach more closely together, and the apical spot is absent. This species belongs in group I of Dr. Dietz's revision, and can readily be separated from the two American species by the inner dorsal mark, which in both extends from dorsal to costal margin.

Named in honour of Rev. G. W. Taylor, to whom I am indebted for many interesting specimens.

Amydria crescentella, sp. nov.—Expanse, 16 to 18 mm.

Palpi, head, antennæ and thorax very pale brown, dusted with dark brown, the latter predominant on external surfaces of palpi. Abdomen and legs pale cinereous, tarsi dusted with brown.

Fore wing creamy white, slightly dusted with brown scales; this light ground-colour only occurs in a large triangular basal patch, extending to a quarter on costa and nearly to middle on dorsal margin. A curved oblique fascia from middle of costa to end of cell, a similar but narrower fascia from costa just before apex, curving inwardly towards but not reaching the middle fâscia. These two fascias are so sharply defined against the dark brown of the balance of the wing that they appear as a crescent-shaped band, interrupted in the middle.

The balance of the wing is cinnamon-brown, dotted with darker brown. In some specimens the pale basal area is rather heavily dusted with brown inwardly, leaving only the margin of the pale colour, forming a narrow oblique fascia. On the costa, within the crescent, are two pale dashes separated by a dark dot, and outwardly bounded by dark brown, which also extends below them. Before the middle of fascia the costa is cream colour, marked by a number of brown dots. On the outer margin is a line of dark brown dots, separated by a few paler scales. Cilia same as dark portion of wing.

Hind wing light cinnamon-brown, under side of both wings the same.

Five specimens, all Baboquivaria Mountains, Pima C., Arizona, July 15 to 30; two collected by Prof. F. H. Snow, three by Mr. O. C. Poling.

Types, University of Kansas and in my collection.

(To be continued.)

NEW SPECIES OF NORTH AMERICAN LEPIDOPTERA.

BY WM. BARNES, S.B., M.D., DECATUR, ILLINOIS.

Holomelina calera, n. sp.—Allied to *ostenta*, H. Edw., and *pomponia*, Druce, especially the latter.

♀. Expanse, 31 mm.

Agrees with Druce's figure, Biol. Centr. Amer. Het., plate 78, fig. 8, and with Hampson's description, Cat. Brit. Mus., Vol III., page 190, with the exception that fore wings have a crimson fascia along the outer margin as well as along costa, while the inner black area on secondaries is not extended to apex, there being only a small black patch on outer margin, just above and almost separated from the inner black area.

This insect will very likely prove to be a variety of *pomponia*, but as I do not know the range of variation of the latter I prefer for the present to consider it distinct.

Type.—One ♀. Huachuca Mts., Ariz., July.

Kodiosoma otero, n. sp.—♀. Expanse, 32 mm.

Fore wings brownish-black, fringe white. Costa narrowly edged with white. Fore wing crossed by narrow white, slightly incurved band at the junction of outer and middle thirds. This band is slightly constricted on median vein and just before reaching inner margin.

Hind wings red, black along costa and outer margin, this border is widest at apex, and gradually narrows out before reaching inner angle, fringe whitish.

Head and thorax black. Collar whitish. Abdomen red with black tip. A dorsal row of black spots. Thorax and abdomen black beneath. Legs black inwardly. Patagia red on outer side ; tarsi white outwardly.

Type.—One ♀. Babaquivera Mts., Ariz., August.

Cerma cuerva, n. sp.—♂. Expanse, 27 mm.

Fore wing powdery, dark brown, with an olive-green tinge, sprinkled more or less with black and white scales. Basal half-line black, quite distinct, dentate. T. a. line dentate, almost transverse, blackish, the space between it and basal half-line somewhat paler than ground colour. T. p. black, edged outwardly with paler shade, extends outward along costa, then quite squarely across cell, thence inwardly to inner margin, quite irregular. Orbicular and reniform distinguished with difficulty, subequal, outlined by a few black scales. S. t. line very obscurely marked. Fringe checkered. Hind wing dark fuscous, with faint mesial band and dot,

fringe a trifle paler, with slightly darker mesial line. Head and thorax concolorous with fore wing, abdomen with hind. Basal joints of palpi black, tip yellowish-white.

Beneath all wings blackish-fuscous, with fairly distinct common mesial band. Fore wing shaded with yellow along costa towards apex. Hind wing with discal dot.

Type.—One ♂. Victoria, B. C., from Mr. A. W. Hanham.

It is possible this may turn out to be the same as *Cerma fascia*, Smith, though from the description and locality I do not think it likely.

Cerma sarepta, n. sp.—♂. Expanse, 22 mm.

Fore wing from base to t. a. line, from t. p. to s. t. line, together with reniform, pale greenish, remainder of wing brown, with somewhat of a bronze cast. Small black point on costa at base ; basal half-line distinct, inclined outwardly, then inwardly. T. a. line rather far from base, black, almost transverse, scalloped. T. p. line rather widely removed, black, irregular. S. t. black, irregular, broken. Fringe checkered. Orbicular not apparent. Reniform pale green, outlined with blackish scales, open above. Head, collar and thorax pale green. Some of the scales, especially on the thorax posteriorly, black-tipped. Hind wing fuscous, with faint discal dot.

Beneath, fore wings pale fuscous, with paler spots indicating position of reniform above. Hind wing paler than fore, rather poorly-marked discal dot and mesial band.

Type.—One ♂. Wilgus, Ariz.

Cerma canoa, n. sp.—Expanse, 22 mm.

Fore wing gray, largely covered with darker gray and blackish-brown scales, not so powdery as most of the other species of this genus. Basal half-line only indicated by pale dot on costa, with a few black scales to inner side. T. a. transverse, fragmentary, represented by a pale patch on costa, one in centre of wing and one on inner margin, each followed by a black shade. The space between basal and t. a. line is dark blackish-brown, cut by longitudinal paler shades into two or three patches. T. p. line white, beginning with short angle on costa to inner side of reniform, thence extending outwardly along costa, then quite squarely around cell, thence with slight inward curve to inner margin, this line is white, quite even and well defined. The space between t. a. and t. p. line is blackish-brown, cut by pale longitudinal shades, leaving a dark patch on costa,

another between ordinary spots, a third just below that and a fourth on inner margin. S. t. line pale, irregularly incised opposite cell and at lower third of wing, here cutting through quite to t. p. line; the space between it and t. p. line is dark brownish-black, and, as just mentioned, is cut into three patches by the s. t. line. Beyond s. t. line the wing is pale grayish. Fringe gray and white checkered, with well-marked line at base, which is evenly and neatly cut into short bars by the same white dashes which cut the fringe. Orbicular minute white point. Reniform white-ringed, darker centered, rather narrow. The markings on the fore wing are neat and distinct, giving a well-marked checkered appearance, quite different from any other species in the genus. Hind wing dark fuscous, with a very faint discal dot and mesial band. Fringe pale, with darker mesial band.

Head and thorax concolorous with fore wing, abdomen with hind.

Beneath, fore wings fuscous, with obscure discal mark. Hind wing paler, with distinct discal dot and well-marked mesial band.

Type.—One ♂. Redington, Ariz.

Oligia ensina, n. sp.—♂. Expanse, 28 mm.

Fore wing reddish-brown. Basal half-line distinct, double, pale-filled. T. a. double, dark brownish-black, transverse across cell, then somewhat outwardly to inner margin, slightly scalloped. The upper half of wing, between basal half-line and t. a., dark blackish-brown, forming a strongly contrasting subquadrangular patch. Median shade not well marked, somewhat irregular and dentate. T. p. line double, pale-filled, inner portion more prominent, slightly scalloped. The space between t. a. and t. p. line is quite evenly coloured, there being, however, some blackish scales along costa, above reniform and a blackish streak beyond it. S. t. line fragmentary, composed of pale blotches between veins, the space between it and t. p. line is slightly darkened, with a well-marked black dash across it below costa, and another beyond lower portion of cell. The terminal space is somewhat paler than subterminal, the veins, however, being rather broadly darkened. A rather faint dark terminal line. Fringe concolorous, somewhat paler at base. Orbicular rather small, concolorous, pale-ringed. Reniform quite strongly inwardly oblique, more or less well-developed tooth projecting inward from lower portion, an outer pale ring, within which is a darker ring, the centre again becoming pale. Lower portion with some blackish scales. Hind wing pale blackish-fuscous, darker outwardly, with a well-marked discal dot. Fringe slightly paler, with slightly darker mesial band. Head and lower half of collar

dark blackish-brown, upper half of collar and thorax reddish-brown, concolorous with fore wing. Beneath, fore wing fuscous centrally, with rather even terminal yellowish band. Discal dot and mesial band obscurely marked. Hind wing paler than fore, yellowish along costa and outer margin. Discal dot well marked. Mesial band rather irregular.

In some specimens the inward projection from lower end of reniform is very slight. Otherwise there seems to be little variation in the species.

Type.— ♂. Huachuca Mts., Arizona, August.

Dypterygia minorata, n. sp.— ♀. Expanse, 30 mm.

Fore wing dead black, exactly the same shade as *scabriuscula*, which species the present one resembles in a general way. The fore wing is crossed and marked with a number of velvety-black fragmentary lines, as well as blackish streaks along veins. A few whitish scales along the outer end of cell indicate position of reniform. The s. t. line can be made out in an indefinite way, but is only well marked at inner margin. The outer portion of the wing is lightened with flesh-coloured shades, quite well marked at inner angle beyond t. p. line, and has a W mark in centre of wing, cutting through fringe. Inner margin also presents a narrow flesh-coloured band, crossed by a couple of black streaks. Fringe slightly scalloped, concolorous, with an admixture of flesh-coloured scales. Three minute flesh-coloured dots on costa before apex, preceding which are four or five outwardly oblique black bars, indicating the inception of ordinary lines.

Hind wings blackish-fuscous, darker outwardly, with barely traceable pale mesial band, fringe pale, somewhat darkened from apex to middle.

Beneath, fore wings smooth, even blackish-brown, gray, with a fleshy tinge along costa, somewhat paler at outer edge. The beginning of the mesial band can be seen, but not traced across wing. Hind wing yellowish-white towards base, reddish-brown along costa and beyond the well-marked mesial band.

Head and collar gray, mixed with flesh-coloured scales. Well-marked narrow black band through middle of collar. Thorax concolorous with fore wings. Patagiæ with some black scales along border. Thorax posteriorly with many flesh-coloured scales, forming a pale spot as in *scabriuscula*, though not so distinct.

Type.— ♀. Santa Catalina Mts., Ariz. Other specimens from Kerrville, Texas.

Papaipema peralta, n. sp.—Expanse, 25 mm.

Ground colour seal-brown, with slight olivaceous tint. Ordinary markings faintly indicated by fine delicate tracings of white scales. Remaining portions of fore wing are also sparingly dusted with white. Basal half-line scarcely to be distinguished. T. a. line rather straight, inclined outwardly to middle of inner margin, slightly wavy. T. p. line slightly outcurved over cell, thence almost in a straight line to inner margin, two or three millimeters beyond t. a. line. S. t. line faintly indicated. A scalloped terminal line and white line at base of fringes, which are in turn tipped with white. Orbicular moderate in size, round, concolorous. Reniform subquadrangular, rather large, concolorous, pale linear streak through centre. Several white points along costa. The wing is a trifle darker through the median space than either before or after it. Hind wings similar in colour to fore, though somewhat more blackish outwardly and more yellowish inwardly. Discal bar obscurely marked. Fringe paler than wing, with dark mesial band. Head and thorax concolorous with fore wing, scales tipped with white. Abdomen concolorous with hind wing. Thoracic crest well marked in one specimen.

Beneath, fore wing dark centrally, paler along inner and outer margins. Three or four pale dots on costa near apex. Hind wing paler than fore. Not very prominent discal dot and mesial band. Faint traces of mesial band also in fore wing. Body parts beneath concolorous with wings.

Type.—Several specimens. Cochise Co., Ariz. *Peralta* is the smallest species of the genus known to me, and without the endorsement of Prof. J. B. Smith I should hardly have thought of placing it in this genus.

Mamestra Antonito, n. sp.—♂. Expanse, 35 mm.

Fore wings, ground colour rather pale pearly-gray, with somewhat of a greenish-yellow cast. In most places largely obscured by dark brown and black shades and lines. Basal line double, fragmentary, pale-filled, indicated chiefly by dots on costa and below median vein. T. a. slightly outwardly oblique, irregularly dentate, double, pale-filled, outer line distinct, inner only apparent as dot on costa. Black diffuse median shade. T. p. line moderately exserted beyond cell, thence with slight inward curve to inner margin. Inner portion black, distinct, scalloped, with outward projections on veins, outer portion scarcely traceable. A series of small black points on veins beyond line. S. t. line white, incomplete and rather fragmentary, preceded by some black scales and followed by well-marked

black shade, most distinct opposite cell and towards inner angle. The s. t. line is projected through to outer margin, forming a rather obscure W mark in centre of wing. The mesial portion of wing is more covered with black scales than the subterminal. Orbicular distinct, round, black-ringed, pale, with dusky centre. Reniform, kidney-shaped, large, erect, distinct, filled with ground colour, somewhat darkened at upper and lower portion. Claviform short, outlined in black. A black wavy line at base of fringe, which is dark and cut with white at ends of veins. Hind wings fuscous brown, with rather distinct discal bar. Fringe slightly paler, with slightly darkened line at base.

Beneath, fore wing grayish along costa and outer margin, else pale-fuscous. Mesial band extending partly across wing from costa. Orbicular and reniform evident as pale rings. Fringe checkered. Hind wings somewhat paler than fore, more grayish throughout. Discal bar and median band. Head, collar and thorax mottled, concolorous with fore wing, abdomen with hind wing. Antennæ bipectinate in male.

Types.—Huachuca Mts., Ariz.

Mamestra Palmillo, n. sp.—Expanse, 40 mm.

Fore wings yellowish-brown, with darker purplish shades. Basal line barely traceable. T. a. line not discernible in the specimen before me, though possibly it would be so in a fresher specimen. T. p. line noticeably exserted beyond cell, scalloped between veins. S. t. line indicated by a slight darkening of the wing before it. Veins darkened, especially in terminal portion of wing. The shade before s. t. line is emphasized in the intervenular spaces. Fringe concolorous, with well-marked darker blotches between ends of veins. Shallow dark lunules at edge of wing between veins. Orbicular round, dark-ringed, centre concolorous. Reniform of good size, upright, constricted in centre, dark-ringed, within which is a second dark ring, filling concolorous. Claviform present, moderate in size, dark-ringed. Hind wing pale yellowish-white, fringe somewhat darker from admixture of yellow and purplish-brown hairs.

Head and thorax concolorous with fore wings, the patagiæ being bordered with somewhat darker hairs, as is also the thorax posteriorly.

Abdomen with somewhat more of a pinkish tinge than wings.

Beneath, fore wings somewhat paler than above, slightly darkened towards costa and apex. Fringe checkered. Hind wings similar to fore, except the fringe is not checkered.

Type.—Southern Arizona.

(To be continued.)

INSECTS AS THE FOOD OF SQUIRRELS.

BY WM. T. DAVIS, NEW BRIGHTON, N. Y.

Toward the end of August and early in September many acorns, with their cups attached, fall from the oaks and lie beneath the parent trees. When first they reach the ground they look perfect, but directly the *Balaninus* larvæ begin to bore out through the cups and enter the ground, as is their habit. When they escape from hickory-nuts, the larvæ of these long-snouted beetles choose the thin places between the ridges, which are so characteristic of the shell-bark nuts, for instance, and the easiest way out from an acorn must be through its base and cup. The larvæ, however, may be cut short at this part of their development, for they are much sought after by squirrels, who seem to esteem them highly. The problem that presents itself to the squirrel is to tell which acorns contain larvæ. He makes, considering the conditions, the simplest and most direct test. He bites a small part of the cup off so as to expose the base of the acorn, and then punctures it slightly. He can, no doubt, tell very quickly by the odour if there is a larva within, and if such proves to be the case, the hole is enlarged and the much-desired morsel secured. I have found on Staten Island scores of the large acorns of the red oak that had been treated as mentioned above, and on another occasion many scarlet-oak acorns that had been treated in the same way, all of which goes to show how enterprising and intelligent the squirrels really are.

Another example of the insect-eating habit of a squirrel was observed at Lakehurst, N. J., where beneath a pitch-pine tree, mid the scattered remains of many cones, from which the seeds had been extracted, were found a number of *Clisiocampa* cocoons. They had been brought from a near-by wild-cherry tree, that had been badly eaten by these larvæ, and still contained some of their old tents. Each cocoon had been opened either at the end or side, and the pupa extracted. Certainly in this instance the squirrel did a good act, and also showed his liking for insects.

On the 29th of June, some years ago, I saw a chipmunk catch a moth, pull off its wings, and eat it. I have often fed captive gray and flying squirrels bits of raw meat, so their fondness for *Balaninus* larvæ and other insects is not to be wondered at, but what is chiefly of interest is the intelligence shown in making their captures.

A FEROCIOUS WATER-BUG.

BY G. W. HARVEY, ADIN, CALIFORNIA.

In the warmer streams and pools of California lives a creature whose character is very aptly portrayed by the above title. He is not only ferocious, but a cannibal as well.

Among the boys and girls who go wading in the streams this fierce bug is known by the name of "toe pincher," because he frequently mistakes their bare toes for lawful quarry, and thrusts savagely into them with his scimitar-like proboscis. They tell me that his bite is very painful, though not at all dangerous.

Scientifically he bears the title of *Pedinocoris macronyx*, Mayr. He is of a uniform dull brown colour, with a barely perceptible mottling on the wing-sheaths or elytra. The females are possibly a shade darker than the males. He has prominent, you might say protruding, black beady eyes, and his head terminates in a long curved proboscis, seven mm. in length, which gives him a very odd and fiendish appearance. His legs are perceptibly hairy, and armed with sharp, curved claws, very long and prominent on the two front legs, which are strong and so placed that they work in a vertical plane, jointed at an acute angle, and might easily be mistaken for jaws or mandibles. The claws on these front legs are jointed so that they can be bent down upon the first joint of the leg, virtually clamping the prey in a vice, as it were. It is with these that he seizes his prey, and holds them in a herculean grip until devoured. He is three and a half centimetres long, with a reach of one and a half cm. more in his two front legs, and is two cm. broad across the widest part of the back.

His range extends from northern California—possibly further north—to Central America, and very likely on into South America.

He is gifted with a voracious appetite, and his aggressive prowess as a hunter is something appalling to the owner of an aquarium who chances to secure him as a specimen, without having made his previous acquaintance. I well remember my first experience.

I had a beautiful collection of aquatic insects, fish and tadpoles from the streams about Watsonville, California, and it was on one of my collecting rambles that I discovered Mr. *Pedinocoris*. He was a wonder to me, and I took him home, highly elated over the prospect of a new creature to study.

It was about nightfall when I placed him in the aquarium, and I was around early the next morning to see how he had fared in his new quarters. Imagine my surprise to find him sitting complacently on a stock of *Sagittarius* devouring the largest fish in my collection, a beautiful trout about three inches long, while all about his new quarters were scattered the skins of many victims, including young frogs, tadpoles, fish, snails and various other smaller fry. He had fared altogether too well, much like a weasel in a henhouse, with a propensity to kill everything in sight. At that rate he would very soon totally depopulate my aquarium, so I removed him to less commodious and more sparsely populated quarters, and confined him to a diet of tadpoles and froglings. He would devour dozens of them in twenty-four hours, and have his quarters fairly stinking with their remains.

He captured his prey as they swam near him by a sudden dart forward. The powerful hooked front legs were thrown over the victim, which was pinned fast more quickly than the eye could follow, and the sharp, curved, horny-pointed proboscis was thrust into its quivering sides, never to be withdrawn until the skin was a limp and flabby sack of lifeless material perfectly depleted of all the nourishing liquids and elements pertaining to the body in life. His habit was to lurk in the more secluded and darkened places in the aquarium, backing up occasionally to the surface for a breath of fresh air, and quite often I would see him, after returning to his lurking place, raising and lowering the wing-sheaths as though breathing, and beneath them could be seen a large bubble of air, advancing and receding with the up and down motion of the wings, and looking for all the world like molten shining silver. The spiracles are quite prominent, and placed at the lower extremity of the abdomen, as is usual in water-beetles.

Sometimes I would take him from the water, and then he would "play possum" for from three to seven minutes, but when he did wake up was full of life and action. If I caught him and held him securely, he would, after a moment or two, eject a few drops of clear liquid from the spiracles with such force that it often bespattered objects three and four feet distant.

Occasionally he would entertain me with a semi-subaqueous serenade. He would come to the surface, where there was a thick mass of duck-weed floating, extrude the spiracles, and make a soft chirping noise, not wholly unlike a subdued cricket song. I puzzled over this a long time

before I could make out just where the noise came from, but I finally succeeded in observing him in the act, and verified it many times afterward. That a song could emanate from so odd a source as the ventral spiracles of a water-bug seemed ultra-natural, but there was no disputing the facts. When engaged in his chirping, one had to look very closely among the duck-weed to discover the spiracles, but once found, a rhythmical contraction and relaxation could be distinctly noted with every note of the song, which was produced much more slowly than that of our crickets.

The breeding season of this creature at Watsonville, California, where it is very abundant, is from April to June, and during this time from two to four sets of eggs are hatched, and it is one of the most interesting insects to study in all the domain of entomology.

The female glues the eggs of the clutch tight and fast to the back of the male, thereby sealing his wing-covers into a solid case, so that it is impossible for him to fly. Here they stay through the whole period of incubation, unless by some accident their bearer is removed from the water for some considerable time, when the whole mass of nidus and eggs sheds off, and leaves the male free to fly once more to his wonted element.

In depositing the eggs, a translucent adhesive precedes the egg, which is partly incased within it, adheres to and stiffens upon the wing-sheath, holding the egg in a more or less perpendicular position upon the back of the male. I would be glad to know the composition of this mucilaginous adhesive, that will remain plastic at so low a temperature, harden and remain tenaciously adherent in water. The eggs are deposited one at a time, close together, and stand at all angles, from perpendicular in the centre to a cant of forty-five degrees upon the outer edges of the nidus. . They are not all deposited at one time. Part of them will be deposited one night and the rest the next night, or possibly it may be several days before they are all deposited. The female will lay anywhere from seventy to one hundred and seventy-five eggs upon the back of the male, and strangest of all, every egg is right end up, so that in hatching the young insect always escapes from the top of the egg. It very often happens that some of the eggs prove to be unfertile, and whenever they do, instead of remaining in the nidus in an addled condition until the others hatch, they loosen, and are shed off from among the mass of fertile eggs,

and are replaced with fertile ones. This takes place as late even as the eighth day of incubation.

The duration of incubation is from ten to twelve days, at the end of which time the egg-cases and adhesive nidus that holds them are cast off entire, providing there be no late-laid eggs, in which instance the whole mass, including empty eggs and nidus, remain attached to the back of the male until the last one is hatched. And just why it is that a few unfertile eggs will drop away from among the mass of fertile ones and leave the parent before incubation is complete, whereas, on the other hand, the empty egg cases and nidus remain until the very last laid egg is hatched, I cannot understand.

The eggs are a long oval, five mm. long by one mm. thick, and are the same colour as the parent bug. The cast-off nidus and egg cases resemble a knobbed shield as nearly as anything that I can think off, being an oblong oval, with concave surface to back of parent.

During the period of incubation the male spends much of his time in aerating the eggs. This is done by gently raising and lowering the wings so that the air taken in at the surface, and held under the wing-cases, is moved back and forth beneath the mass of eggs, which take it up little at a time, as the needs of incubation require. The adhesive nidus into which the eggs are set must perform the same office or function for the gestating insect that the placenta in warm-blooded creatures performs for their gestating young, with this difference, that in warm-blooded animals air is taken into the blood from the lungs, and transferred to the placenta through the circulation, while in the creature under discussion the air is absorbed directly through the pores of the wing-sheaths.

At the end of incubation the male comes to the surface, and with his back partly out of the water, the young begin to appear.

The first thing seen after the rupture of the egg.case is the beady-black eyes. Then the male continually raises and lowers the wing-sheaths and executes a jerking motion along with it, at regular intervals. The young insect is extruded from the egg-case by easy stages, and in a manner very similar to the birth of a mammal. I am not sure whether the power of extrusion lays wholly in the egg-case or not, but incline to the belief that some pneumatic pressure is brought to bear on the fœtal insect from the air beneath the wing-sheaths of the male, which is kept in constant motion, and which of necessity must exert more or less pressure,

In from seven to twenty-five minutes the birth is accomplished, and you have before you a perfect counterpart of the parent, quickly swimming free and ready for a meal. At birth the insect is about five mm. long by two and a half mm. broad, of the purest white, rapidly changing to light straw-yellow and brown, and in two or three hours at most they are the same colour as the parent, and if prey be not abundant, very likely feasting on their younger brothers and sisters. This latter trait is evidently an hereditary one, because the parent very often makes a meal off his own offspring.

I noticed one peculiar thing in regard to the birth of these insects, and that was, when the birth was forcibly terminated by my assistance they were not properly vivified. They would lie for many minutes apparently half dead, whereas those that were maturely born were lively and perfectly vivified. Nature's ways are marvellous, and the birth of an insect is just as elaborately provided for as that of the higher animals.

These creatures disdain nothing in the food line that they can handle, either dead or alive. They often come to the surface for floating insects, worms, caterpillars, moths, butterflies, dragon-flies, grasshoppers, crickets, etc., etc., and after extracting all the nourishing properties by suction, cast the empty skin aside.

Their migrations are performed after night, as is the habit of the so-called "electric-light bug."

So far I have discovered but two species of this insect, one inhabiting the warmer zones of California and countries further south, and which I have described in this article, and a smaller variety that inhabits the warm springs of Northern California, and which is hardly half the size of the one here reported.

PREOCCUPIED NAMES OF BEES.

Through the kindness of Prof. Cockerell I have learned that two names recently used by me are preoccupied, and therefore propose the following:

Centris Costaricensis, n. n., for *C. Friesei*, Cwfd., in Trans. Am. Ent. Soc., XXXII, 158.

Halictus glabriventris, n. n., for *H. Vachali*, Cwfd., in CAN. ENT., XXXVIII, 300.

J. C. CRAWFORD, Dallas, Texas.

NOMENIA AND EUCHŒCA FINALE.

BY RICHARD F. PEARSALL, BROOKLYN, N. Y.

In replying to recent papers by Dr. Dyar[1] and Rev. G. W. Taylor,[2] my desire is to end a controversy, not prolong it. First, as to Nomenia. When this genus was established, it was understood by most entomologists that the western species of Euchœca, which had been associated with it, was a form of our eastern species, now known to be the *comptaria* of Walker, thus the name of *12-lineata* was affixed to the type. Later, when it became apparent, with more material at hand, that the western species of Euchœca was really distinct, it seemed to me that Dr. Packard's description applied, with its reference to the antennæ as "well ciliated" to this Euchœca, not to Nomenia with its unipectinate antennæ; hence, I was using a preoccupied name, and described the Nomenia as *unipecta*. My desire was to make the description fit best the species placed under it. To my mind the description will cover either species, excepting the antennal structure, yet, offsetting this come the two references on pages 83 and 86 of the Monograph, where he states, first that they are pectinate, and again that they are not. But Dr. Dyar says I violated established usage in so doing, and though unconvinced, to close an argument, I will accept their decision, acknowledging the compliment extended by both, in using my name for the Euchœca species.

As to Euchœca: Dr. Dyar supposes I had neglected the names of *condensata* and *inclinataria*, Walker, but I had learned through examples of *lucata*, Guen., sent to Mr. L. B. Prout for comparison with Walker's type in the Brit. Mus., that *condensata* was the same. I quote his reply:

"Euchœca lucata, Guen. (teste, Packard) = condensata, Walk., certissime!" The absence of marginal black line in *lucata* and in the Walker type makes this certain, if any doubt existed. *Inclinitaria* is, vide Hulst (Entom. News, Vol. 6, p. 70, 1895), a synonym of ferrugata, Clerk, and this has been confirmed.

When Dr. Packard described *perlineata* in his Monograph, 1876, he assembled under it the original types described in 1873 from Albany, N. Y., May 4 (Lintner), Brooklyn, N. Y. (Graef), West Virginia, April (Mead), Mt. Washington, N. H., July (Morrison). The dates given, as I

1. CAN. ENT., Vol. 38, page 110.
2. CAN. ENT., Vol. 38, page 203.

will show, are very important. *Perlineata* flies very early, and is short-lived. The West Virginia types (co-types we would call them now) in April. I have it from New Brighton, Pa., April 13–May 5. In this locality I take it from April 21–May 2. The Albany types May 4. Last year I went to the Catskill Mts., fifty miles from Albany, on May 23, hoping to take it there. I saw none, and rashly published the statement that it was not found there. This year I went on May 2nd, and found it flying, taking up to May 14 some 17 specimens, after that only one worn-out ♀ on May 20, though I searched diligently.

Exhumata did not make its appearance until two weeks later, June 4, its usual time as shown by my dates of the past ten years, and was common until the second week of July. Now, eliminating from the group those from Brooklyn, N. Y. (Graef), as without date, the above record will show, with the exception of those from Mt. Washington, N. H., July (Morrison), they were, including the Albany types, all examples of *perlineata*, while the date (July) tells plainly that those from New Hampshire were as surely *exhumata*. These last were figured on plate, as Mr. Taylor points out, and if the statement that for thirty years we have given to this species the name of *perlineata* has any force, which it has not, I would point out that Dr. Packard committed an error precisely similar in the case of *Caripeta angustiorata*, recently published by Mr. Swett (Journal N. Y. Ent. Soc., Vol. 14, page 128).

Descriptions I do not underestimate, I trust, and in this case I have examples of *perlineata* which answer well to it. If we are to be allowed to arbitrarily set aside the types or co-types upon which an author bases his description, as Mr. Taylor has done, it must be, in my judgment, for better reasons than exist in this case.

Hence, I hold to my conviction that *12-lineata* having "gone west," where it rightly belongs, that *perlineata*, as represented by the co-types in the Packard collection, is the *comptaria* of Walker, and that *exhumata* is to remain a valid species.

NOTE.—Since writing the above the thought occurred to me that perhaps the original types of *perlineata* had been returned to Dr. Lintner. I addressed a query to Dr. E. P. Felt, State Entom., and his reply, "The types of *Larentia perlineata*, Pack., are in the Lintner collection, and in excellent condition," caused me to journey to Albany to inspect them. The types are the same with those in the Packard coll. from West Va.

(Mead), and bear the label in Dr. Packard's handwriting, "Larentia perlineata, Pack., Albany (Lint.), type," and another old label in Dr. Lintner's hand, "May 4, '70." Dr. Packard had only this pair before him in 1873 when his description, which was copied almost verbatim in the Monograph, was made. In view of this fact, the contention of Mr. Taylor, that the description was made from another species, has no weight, and his argument, based upon *description* alone, though strongly and skillfully presented, is shown by these types to be worthless. *Descriptions* make the world acquainted with the type, but were never intended to take precedence of it, just *because* they are open to individual construction as to their meaning.

Exhumata is represented by five examples, one labeled White Mts., two from Schenectady, N. Y., July 10, 1876, and June 12, 1875. These three are called "Oporabia 12-lineata, Pack." The other two are from Stony Clove, Catskill Mts., June 26, 1874, and labeled "Epirrhita 12-lineata, Pack." (note the date), though Mr. Taylor asserts that the species has universally been known as *perlineata* for thirty years past.

Really, no one knew what to call his specimen until now, and I feel that the thanks of the entomological fraternity are due the CANADIAN ENTOMOLOGIST for the valuable space it has accorded us in "threshing out" the real status of the members of this group.

Incidentally, *Caripeta angustiorata* is represented in the Lintner collection by three examples, two of which are the *criminosa*, Swett, a distinct and well-marked species.

The species following will stand in the future as indicated:

Nomenia duodecimlineata, Packard.
= unipecta, Pearsall.
Nomenia duodecimlineata, Pack.
var. secunda, Pearsall.
Euchœca Pearsalli, Dyar.
= 12-lineata, Auct. (western).
Euchœca comptaria, Walker.
= 12-lineata, Auct. (eastern).
= perlineata, Pack.
= salienta, Pearsall.
Euchœca exhumata, Pearsall.
Euchœca lucata, Guenee.
= condensata, Walk.

NOTES ON SOME NEW MOSQUITOES FROM JAMAICA, WEST INDIES.

BY M. GRABHAM, KINGSTON, JAMAICA.

The following are brief notices of three new species of mosquitoes, full accounts of which will be published in the second edition of "The Mosquitoes or Culicidæ of Jamaica," now in course of preparation.

Ædes uncatus, n. sp.—Close to *Stegomyia mediovittata*, Coq., from Santo Domingo (CAN. ENT., Feb., 1906, p. 60), but the subdorsal thoracic lines are made up of light yellow scales throughout their whole length. Full-grown larva with six or seven separate comb scales, each scale with a simple stout curved spine arising from a pear-shaped base. (Fig. 1.)

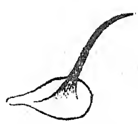

FIG. 1. – Scale from comb of Ædes uncatus.

The larvæ of this form, collected from hollow trees, have been sent to me from several localities near Kingston (Waverley Estate, Constant Spring: woods above Rockfort). In all the specimens examined the comb scales had simple spines unlike the Santo Domingan form, which has trifid spines (Dyar and Knab, Jour. N. Y. Ent. Soc., XIV, Pl. V, fig. 11). I am indebted to Dr. H. G. Dyar for comparing the larvæ and adults of these two species. Bred specimens vary greatly in size, the largest attaining about 6 mm. in length. The females bite blood without hesitation.

Mansonia Waverleyi, n. sp.—Close to *M. signifer*, Coq., but with an additional curved line of white scales on each side of the mesothorax. (Fig. 2.) This line is usually somewhat broken. I am likewise indebted to Dr. Dyar for examining the larvæ and adults of this species; he writes that the larvæ also differ in the arrangement of the abdominal plates. The larvæ were collected from thick coffee-like water found in hollow mango trees at Waverley Estate, Constant Spring, Jamaica. They are grayish-white in colour, and appear to be peculiarly inactive, lying at the bottom of the jar for long intervals. The pupa stage lasted five days. Length of adult 5.5 mm.

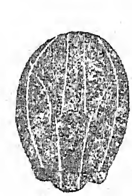

FIG. 2.—Thoracic ornamentation: Mansonia Waverleyi.

Howardina inæqualis, n. sp.—Near *H. aureostriata*, Gbm. (CAN. ENT., May, 1906), but with somewhat broader thoracic lines. The face hairs of the larva are as follows: Anteantennal hair 5- to 8-rayed, upper epistomal hair double, lower about 10-rayed. The compound hair of the dorsal group in the terminal segment is about

6-rayed. In *H. aureostriata* the upper epistomal hair is usually single, and the compound hair of the dorsal group on the terminal segment is 10–12-rayed. The most notable differences are to be observed in the anal gills, those of *H. inæqualis* being broadly lanceolate and pigmented, the lower pair only one-half the length of the upper pair, which are one-third the length of the longest hairs of the ventral hair group, while in *H. aureostriata* they are nearly equal in size, narrow, slender and transparent, and about as long as the hairs of the ventral tuft. The larvæ collected from hollow trees (chiefly *Anona palustris*, L.) by the seashore, Kingston, have long, slender, pale red bodies, covered with rayed hairs; a pair of large air vessels in the thorax are seen as two conspicuous silvery spots. The females are troublesome blood-suckers in the woods. Length of adult, 2.5 mm.

NOTES ON THE SWARMING OF A SPECIES OF CRANE FLY.

BY CHAS. N. AINSLIE, WASHINGTON, D. C.

The swarming habits of various families of flies, notably the Chironomidæ and Culicidæ, have been known to the world probably for centuries, since even unscientific people must have often been interested in the phenomenon, perhaps, indeed, alarmed at it, so prodigious have sometimes been the numbers of flies involved in these gatherings. Accounts of extraordinary swarms have been current in print for more than a hundred years, but these stories deal for the most part with the size and actions of the mass of flies, and rarely attempt an adequate explanation of the peculiar gathering, from the view-point of the individual insect. A few species of the Tipulidæ have been noted as celebrating the same sort of air dance as the smaller forms, but I have been able to find nothing in print that describes in detail the mysterious performance. Having been fortunate enough recently to witness and study this feature of the life-history of one species of the Tipulidæ, *Trichocera bimacula*, I venture to record the notes made at the time, in the hope that some more competent observer may write a more complete story than is possible for me.

Nov. 2nd, 1906, was a clear, cool day, with a fresh northwest breeze. Toward sundown the wind died away to an occasional, hardly-perceptible breath, and the mercury fell to a point where it was quite chilly, perhaps to between 45 and 50 degrees above zero, Fahr. The writer chanced to be returning to Washington from Arlington on foot, and the way led along the steam car track, which at one point skirts the bank of the Potomac,

not more than a stone's throw from the tide-water mark. The railway is here bordered by thickets of brush that fence both sides, and make an open lane not much wider than the roadbed. The sun was just sinking behind the heights of Arlington, and the air was decidedly cool as I reached the track. In spite of the chill, or more properly, I suppose, because of it, the lane through the underbrush was occupied by dancing swarms of Trichocera that hovered at various heights from three feet to ten, each swarm maintaining itself in a fairly constant position, except when a whiff of air blew it about. Occasionally these assemblies would coalesce or subdivide, but not often. The swarms were of all sizes, from a dozen or two individuals up to hundreds.

It required several minutes of close attention to get an intelligent idea of the individual movement within each collection of dancers. The first impression was of chaotic activity, a sort of delirious motion without order or purpose. And it was only by singling out and following an individual that the riddle was read. Each fly went through three movements, and repeated these continually, a slow curving rise for ten or fifteen inches, a rapid perpendicular fall, and a peculiar swaying flight that affected the exact position of the swarm in the air. Even after the movement had been analyzed, a look through the swarm at an object beyond gave the former effect of whirling atoms and rapid motion.

A sweep of the net through a swarm revealed, as I had expected, that only males were performing the airy incantation. But the "canto" was unheard, probably because of the much slower wing-motion of the Tipulidæ as compared with the smaller and more active midges, with their high-keyed song. At any rate, I was unable to hear any sound from even the largest swarm.

Creeping cautiously beneath a well-defined body of dancers, I was able to watch them clearly outlined against the fast-darkening sky and see every movement. No females were observed to fly into the swarm, yet before I left for home I was able to distinguish a difference in the swing of the flies, that indicated the presence of a female. Just what the difference was is hard to describe, but somehow the dancers, instead of neatly avoiding each other as before, would interfere, the lines of flight seemed to be more angular and less graceful, a series of tackles could be distinguished as if a number of small fights were in progress, until finally a pair would drop from the swarm, clumsily steering for the grass and bushes that bordered the open.

For some reason, either the scarcity of females, the coolness of the evening, or the lateness of the hour, these matings were infrequent, and during the hour I remained I saw less than a dozen pairs leave the throng. Several times I captured the pair as it was flying away, and except in one case, when the net engaged an extra male, evidently a straggler from the swarm, I took only a male and female. It might be remarked in passing that in this particular species at least the sexes are easily distinguished.

The exact manner in which mating was accomplished could not be ascertained with any definiteness, the interval between pairing and disappearance being so extremely brief that extended observations were impossible. The claws of the species are simple, and if the same rule holds that Mr. Knab finds obtains among the Culicidæ, the act of mating is a simple embrace, without the swinging apart that has been observed among the tooth-clawed mosquitoes.

As is probably the case with most, if not all, weak-winged flies when maintaining their equilibrium in a definite spot in mid-air, these Tipulidæ were observed always to face toward the light air-currents that from time to time came through their ranks and blew them gently about.

An hour of close watching failed to discover any variations in the simple movements of their performance. The gathering darkness, while putting an end to observation, seemed to be no check to their gaiety, for their numbers were not diminishing when I left the scene. Possibly, after the manner often noticed among so-called sentient beings, the amusement may have lasted far into the night.

ERRATA.—Vol. XXXVIII., p. 400, line 12 from bottom, for "sickly" read "silky."

Page 425, line 7 from bottom, for "Xanthorhöe *possaria*" read "*fossaria*."

The Editor much regrets the delay in issuing this first number of a new volume of "THE CANADIAN ENTOMOLOGIST"; it has been caused by his absence from home attending the recent scientific meetings in New York.

Subscribers are reminded that the annual subscription of one dollar is now due, and should be sent to the Treasurer by Post-office or Express money order (not by a cheque on a local bank) or by registered letter. As a rule, the magazine is sent until ordered to be discontinued, so as to relieve subscribers of inconvenience.

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NOTES ON CHALCOLEPIDIUS AND THE ZOPHERINI.

BY THOS. L. CASEY, WASHINGTON, D. C.

The species and subspecies of *Chalcolepidius* having the side margins of the upper surface densely clothed with white or whitish scales, are very numerous in Arizona and northern Mexico, constituting one of the characteristic northern types of the genus. The recent appearance of a paper by Dr. Otto Schwarz (Deutsche Ent. Zeit., 1906, p. 97), describing two of these forms, has suggested the general revision here attempted, although, after careful study of these descriptions, I am forced to the conclusion that *substriatus* is nothing more than a slight modification of the typical *Webbi*, Lec., in which the lateral white vittæ of the pronotum are sometimes transversely coalescent at the middle of the length, and that *parallelus* is identical with *tartarus* Fall. Most of the new forms here described were taken by Prof. F. H. Snow, in the course of his many fruitful expeditions to Arizona.

Because of the want of data which might in any way enable me to determine or even infer their true relationships with the material at hand, I have tentatively assumed all the forms described to have the weight of species, not attempting to indicate those that may prove ultimately to be more properly subspecies. A few new Mexican species are also included in the following table :

1\. Scutellum triangular, flat, deflexed and evidently notched anteriorly.. 2

Scutellum triangular, deflexed but not evidently notched anteriorly; antennæ pectinate in the male, serrate in the female, the third joint but little longer than the second, the fourth longer than the two preceding together; body uniformly and more or less densely clothed with brilliant bluish, greenish or coppery squamules, except, as usual, along a denuded median line on the under surface; form narrow, elongate, parallel, only moderately convex, black, shining, the basal angles of the prothorax not or only very feebly everted; descriptions drawn from the female 18

Scutellum transverse, suboval, biimpressed, not emarginate anteriorly; body uniformly clothed with minute close-set olivaceous squamules; antennæ serrate in both sexes; tibiæ not ciliate in the male 20

2. Antennæ serrate in both sexes 3
Antennæ pectinate in the male, serrate in the female, the third joint about half as long as the fourth; body narrow, elongate, rather convex, the elytra moderately narrowed from base to apex; integuments black, shining, uniformly but not very densely clothed with minute olivaceous squamules; elytral striæ deeply impressed, strongly punctured, the intervals uniform and convex; scutellar notch feeble. Atlantic nearctic fauna 17
3. Epipleura in colour and vestiture similar to the marginal parts of the upper surface 4
Epipleura in colour and vestiture similar to the under surface 16
4. Pronotum, and usually the elytra, margined at the sides with dense, closely-decumbent scales, which are larger, flatter and more strigose than those clothing the remainder of the surface, which are very small, pointed, convex, feebly or not strigose and metallic in coloration, forming a more or less pronounced bloom; integuments black throughout; anterior and middle tibiæ generally ciliate beneath in the male 5
Pronotum not vittate at the sides; body black, the elytra and epipleura red; anterior tibiæ ciliate beneath in the male 15
5. Elytral intervals flat or nearly so, sometimes feebly concave, the striæ unimpressed or very feebly impressed and finely punctate 6
Elytral intervals evidently though moderately convex; equal in width, the deeply impressed striæ strongly punctured 13
Elytral intervals very uneven in width, strongly elevated, the striæ sulciform, with the punctures concealed by the dense vestiture of the sulci. Mexico 14
6. Pale pronotal vittæ pure white, unusually broad, dilated inwardly at the middle, where each is much wider than the intervening dark space, the white margin at the sides and base of the elytra unusually wide, the white scales having a tendency to invade also the intervals within the border, from the humeral regions posteriorly; surface rather convex, the minute squamules olivaceous-green, rather dense and more persistent than usual; basal angles of the prothorax slightly everted, the sides becoming strongly convergent and rounded in apical third; third antennal joint more than twice as long as the second, about two-thirds as long as the fourth. Length 25.0–29.0 mm.; width 7.5–8.8 mm. Arizona (Yuma). [= *substriatus*, O. Sch.] *Webbi*, Lec.

Pale pronotal vittæ narrower, more or less nearly half as wide as the intervening dark space, distinctly dilated internally just behind the middle ; third antennal joint as in *Webbi*. 7

Pale vittæ relatively very narrow, much less than half as wide as the intervening dark space, and never dilated internally near the middle; third antennal joint more elongate, about three times as long as the second and but slightly shorter than the fourth, except in *simulans*; species larger in size, the elytral intervals alternating but slightly in width in the females, from which sex all the descriptions are taken ; minute squamules moderately close-set, forming a thin blue to olivaceous bloom, very readily denuded 10

7. Body stouter and strongly convex, the elytra feebly narrowed from the base to about apical third, then more strongly, arcuately narrowed to the tip ; sides of the prothorax arcuately shouldered anteriorly ; minute squamules producing a thin cobalt-blue bloom 8

Body narrow, less convex, the sides of the elytra gradually and almost evenly converging from the base nearly to the narrowly rounded apex, and feebly arcuate ; minute squamules easily denuded as usual, producing an olivaceous bloom as a rule, becoming blue in some cases ; elytral intervals slightly alternating in width 9

8. Strial intervals of the elytra conspicuously alternating in width toward tip ; lateral vittæ of the pronotum and elytra pure white, the under surface with a blue bloom, the hypomera with several widely scattered white scales. Length (♂) 29.0–32.0 mm.; width 9.0–10.0 mm. Arizona (Bill Williams Fork) . . . . *Snowi*, n. sp.

Strial intervals uniform in width throughout or very nearly so ; lateral vittæ yellowish-white, the under surface as in *Snowi;* elytra and prothorax more elongate. Length (♀) 30.0 mm.; width 9.0 mm. Arizona (B. Wms. Fork) . . . . *idoneus*, n. sp.

9. Sides of the prothorax obliquely rounded and shouldered anteriorly ; body smaller and more slender, the abdomen simple, the fourth segment (♂) not at all impressed at the sides ; hypomera usually with numerous white scales clustered longitudinally at the centre. Length 27.0 mm.; width 7.5 mm. Arizona (B. Wms. Fork). . . . . . *Arizonicus*, n. sp.

Sides of the prothorax evenly arcuate, and converging from the middle to the apex, the prothorax about a third longer than wide (♂) or somewhat shorter (♀) ; abdomen in both sexes with a pronounced and clearly limited impression at each side of the fourth segment ;

hypomera without white scales. Length 30.0–32.0 mm.; width 8.8–9.1 mm. Arizona (B. Wms. Fork)........*abdominalis*, n. sp.

10. Elytra scarcely more than twice as long as wide, with the white lateral margin (♀) about twice as wide as in the other three species, and one-fifth as wide as the elytron; third antennal joint two-thirds as long as the fourth; hypomera with same large scattered white scales in addition to the bluish or olivaceous squamules of the general surface; male much smaller, with the intervals alternating in width. Length 29.0–35.0 mm.; width 8.8–11.0 mm. Arizona (B. Wms. Fork) ....*simulans*, n. sp.

Elytra very distinctly more than twice as long as wide, the pale lateral margin very narrow, even in the female, where it is usually a little wider than in the male; hypomera without white scales........11

11. Sides of the elytra strongly converging from the base to the narrowly rounded apex, and feebly arcuate; yellowish-white lateral vittæ of the pronotum extending to the lateral bead at apex; last abdominal segment (♀) much less than twice as wide as long, the sides only moderately oblique. Length 39.0 mm.; width 12.4 mm. Arizona (near Fort Apache)..................*acuminatus*, n. sp.

Sides of the elytra very feebly converging and slightly arcuate to near apical fourth or fifth, then more strongly arcuate and converging to the apex; marginal vittæ of the pronotum flexed inward from the beaded edge toward apex; last abdominal segment (♀) strongly oblique at the sides, fully twice as wide as long..............12

12. Scutellum wider than long; pronotum strongly, irregularly foveate anteriorly and laterally as in *acuminatus*, the sides rather abruptly converging and rounded in apical third, parallel thence to the acute but virtually unreflexed basal angles; marginal vittæ pure white. Length 38.0 mm.; width 12.0 mm. Arizona (near Fort Apache)......................................*Apacheanus*, Csy.

Scutellum longer than wide; pronotum more finely sculptured, the sides broadly arcuate and converging from the middle to the apex, very feebly diverging posteriorly to the slightly and very gradually everted basal angles; side vittæ pale straw-yellow. Length 42.0 mm.; width 12.8 mm. Arizona (Cochise Co.)...... *nobilis*, n. sp.

13. Body parallel, only moderately convex, the elytra arcuately narrowed toward tip, the prothorax rounded at the sides anteriorly, with the lateral vittæ brownish, nearly half as wide as the broad dark space and almost even; minute squamules olivaceous, the under surface

with pale scales on the hypomera and at the sides of the abdomen ; tibiæ not ciliate in the male. Length 28.0–32.0 mm.; width 8.0-9.5 mm. Arizona (Phœnix). [= *parallelus*, O. Sch.]..*tartarus*, Fall

14. Body elongate-oval, the elytra not distinctly wider than the prothorax, the latter narrowed very slightly from the large and feebly everted basal angles to apical third, then more strongly rounded to the apex, the lateral vittæ pale brown in colour, attenuate and retreating from the margin anteriorly, their width at apex a third that at base ; elytra without paler lateral margin, the scales pale brown, dense in the sulci, minute and sparser on the convex intervals ; hypomera without larger pale scales. Length (♀) 32.0 mm.; width 10.0 mm. Mexico (Guerrero)........................ ......*Aztecus*, n. sp.

Body much smaller and still more slender, the elytra not narrowing behind the middle only, as in *Aztecus*, but narrowed from base to apex, with feebly arcuate sides, the prothorax similar, but with the lateral vittæ pure white and less attenuate anteriorly, their apical width about half the basal ; elytra with a narrow white margin, the other vestiture as in *Aztecus;* hypomera with a line of white scales along the central part. Length (♀) 26.0 mm.; width 7.8 mm. Mexico (Guerrero) ....*sodalis*, n. sp.

15. Form parallel, strongly convex, the prothorax, scutellum and entire under surface densely clothed with green squamules, sometimes becoming bluish toward the sides of the first, which is elongate, parallel, broadly, arcuately narrowed in about apical half, with the basal angles strongly and acutely everted; elytra scarcely more than twice as long as wide, parallel, arcuately narrowed near the apex, the striæ impressed, finely punctate, the intervals equal, feebly convex and clothed uniformly and sparsely with extremely minute grayish-blue squamules. Length 33.0–38.0 mm.; width 10.5–13.0 mm. Lower California........ ....*rubripennis*, Lec.

16. Elongate-oval, moderately convex, black, polished, densely clothed throughout above with large white scales, which thickly fill the sulci of the elytra, the prothorax elongate, moderately narrowed from the everted basal angles, more strongly and arcuately toward apex, the surface somewhat rugose, without lateral vittæ ; elytra parallel, arcuately narrowed behind the middle, with deep sulci and convex subequal intervals ; entire under surface, except the usual glabrous median line, densely clothed with rather smaller suberect brown scales. Length 37.0 mm.; width 11.6 mm. Honduras.*amictus*, n. sp.

17. Elytra (♀) nearly two and one-half times as long as wide, the strial punctures toward the sides moderately coarse and well separated; basal angles of the prothorax gradually and feebly everted. Length 24.0 mm.; width 6.2 mm. Pennsylvania. ....*viridipilis*, Say

Elytra (♀) but little more than twice as long as wide, the sulci toward the sides very coarsely punctate or closely foveate; basal angles of the prothorax abruptly and feebly everted and more obtuse. Length 20.0–22.0 mm.; width 5.7–6.0 mm. North Carolina and District of Columbia.................*debilis*, n. sp.

18. Median part of the prosternum narrow, parallel and flat from the anterior lobe to the coxæ; elytra parallel and straight at the sides from the base to slightly behind the middle, then but just visibly converging to the rather broadly rounded tip; elytral striæ very finely punctate, unimpressed; last ventral segment (♀) short and much more than twice as wide as long; tibiæ not ciliate beneath in the male; vestiture only moderately dense, green, varying to coppery in colour. Length (♂ and ♀) 26.0–29.0 mm.; width 6.8–7.5 mm. Arizona (San Bernardino Ranch, Cochise Co.), Snow..*rectus*, n. sp.

Median part of the prosternum broadly convex anteriorly near the apical lobe 19

19. The median part becoming narrow, parallel and flat from before the middle to the coxæ; elytra shorter and broader than in *rectus*, parallel, rounded at the sides of the apex; striæ scarcely impressed, the punctures fine; last ventral (♀) relatively narrower and less abbreviated, less than twice as wide as long; vestiture dense, uniform and bright bluish-green in colour. Length 27.0 mm.; width 7.3 mm. Arizona.............................*smaragdinus*, Lec.

The median part broader, flattened and with posteriorly converging sides from very near the lobe to the coxæ; elytra still shorter and broader, parallel to slightly behind the middle, then rather strongly narrowed and with moderately arcuate sides to the tip, which is relatively narrower than in the two preceding species; sculpture similar; last ventral (♀) strongly trapezoidal, more than twice as wide as long; vestiture very dense, almost uniform greenish-blue, sometimes variegated with cobalt-blue; male much more slender than the female, as in the two preceding species. Length (♂ and ♀) 28.0–30.0 mm.; width 7.4–8.0 mm. Arizona (Bill Williams Fork and Congress Junction), Snow..............*ostentus*, n. sp.

20. Form narrowly elongate-oval, rather strongly convex, the prothorax elongate, broadly rounded and narrowed toward tip, the sides slightly sinuate posteriorly just before the small and sharply everted basal angles; elytra rather strongly narrowed and broadly, feebly arcuate from base to apex, the latter relatively narrow and arcuato-truncate; striæ feebly impressed, finely punctate, the intervals nearly equal and but slightly convex, strongly so at the sides, minutely, not densely punctulate. Length (♂) 28.5 mm.; width 7.6 mm. Arizona (Benson), Dunn .... *Behrensi*, Cand.

The form of the pale margin of the prothorax seems to be comparatively constant and therefore useful in classifying the species as above. The species figured in the "Biologia" as *Webbi*, by Mr. Champion, and subsequently referred to *Apacheanus*, is distinct from both; it has the marginal pronotal vittæ broader than in *Apacheanus* and allies, and slightly dilated inwardly near the middle, a character never observable in those forms. It may be named *Sonoricus* (n. sp.). In like manner the species published on Plate 12 of Vol. III, part 1, fig. 3, of the "Biologia," appears to be more than a variety of *virginalis*, and it may take the name *Championi* (n. sp.). The form given in fig. 8 of the same plate, as a variety of *Desmaresti*, may take the name *brevicollis* (n. sp.); it is narrower and more parallel than *Desmaresti*, with a much shorter prothorax, having a broader median dark vitta and with much finer elytral ridges between the striæ. *Aztecus* and *sodalis*, of the above table, are related to *approximatus*, Er., differing in their much narrower form, less anteriorly converging sides of the prothorax and less dilated elytra, among other characters, and *amictus* is related to *pistorius*, being very much more narrowly oval. The form identified above as *Behrensi*, Cand., may not be wholly identical, but it reasonably satisfies most of the characters of the very short description of that species. The species of *Chalcolepidius* are very local in distribution in the Sonoran regions, as in the case of many other genera.

ZOPHERINI.

The genera of this tribe are well defined in available works, and it is therefore unnecessary to repeat the table given by Leconte and Horn in the "Classification"; it should be mentioned, however, that the genus *Zopherus*, as at present organized, is composed of four genera, three of them at least very sharply delimited and distinct in structure and facies. These genera may be defined as follows:

1. Elytra with distinct and entire epipleura defined by an acute edge; antennal cavities rounded at tip; body rather depressed. Type *Z. Chiliensis*, Gray .... *Megazopherus*
Elytra without clearly defined epipleura 2
2. Antennal cavities posteriorly angulate at apex; body rather large and strongly convex, always pale, with black mottling; pronotum impunctate. [Type *Z. Mexicanus*, Gray] .... *Zopherus*
Antennal cavities rounded at tip; body small, strongly convex, the pronotum punctate 3
3. Elytra not impressed near the suture at apex, each with a large, rounded, flattened and abruptly formed tubercle at tip; body black, sometimes with pale venation or general ground colour, usually only visible at the sides; sculpture very coarse. [Type *Z. limbatus*, Csy.] *Zopherinus*
Elytra impressed at each side of the suture at tip, each with a small oblique ridge at apex; body as far as known deep black, without pale maculation, the sculpture more or less fine. [Type *Z. tristis*, Lec.] *Zopherodes*

The species described by G. H. Horn under the name *Zopherus elegans*, is very exceptional in having the lateral margins pale and the sculpture fine; I have not seen it, but would infer that its structural characters may differ somewhat from those of either *Zopherinus* or *Zopherodes;* it may be attached at present to *Zopherodes*. The type of *Megazopherus* (n. gen.) is the largest species of the tribe. Of *Zopherus*, I have before me one nondescript form, which may be described as follows:

Moderately stout, very convex, the prothorax as wide as the elytra, slightly wider than long, constricted at base, dilated and bisinuate at the sides, yellowish-white, with large spots of black, of which two elongate and approximate, from the base to the middle, sometimes confluent, one at each side before the middle, and the usual transverse spot at the apical margin are unusually distinct; elytra nearly twice as long as wide, with a tolerably regular sutural series of small spots and a marginal series of about five, with other series of small spots much interrupted by very large irregular blotches of black; apex quadrituberculate; under surface black, with numerous black-speckled white blotches. Length 18.0–24.0 mm.; width 7.0–9.0 mm. Mexico (Guerrero) .... *marmoratus*, n. sp.

Belongs near *reticulatus*, Ch., but less tuberculose beneath, and with

much larger and more irregular black blotches on the elytra, about four or five on each, arranged without semblance of order.

ZOPHERINUS, n. gen.

This genus is represented before me by the two following species, of which the first may be regarded as the type :

Elongate, convex, dull in lustre, the tubercles of the elytra feebly shining black, the side margins of the pronotum and elytra finely veined with yellowish-white in about a fifth of the total width ; prothorax slightly elongate, somewhat narrower than the elytra, narrowly rounded at the sides, constricted at base, the surface uneven, sparsely punctate, and with large, very flat tubercles toward the sides ; a quadrilateral of four median indentations usually distinct ; elytra nearly twice as long as wide, with rows of large flattened tubercles, the interspaces coarsely rugose ; under surface black throughout ; posterior ridge of the fifth ventral with a large and parallel-sided median spur projecting anteriorly; the excavation with a tubercle at each side. Length 17.0–20.0 mm.; width 6.0–7.5 mm. Mexico (Amecameca) . . . . *limbatus*, n. sp.

Elongate, very convex, nearly as in *limbatus*, but with a much more shining surface, the elytra less elongate, much wider than the prothorax, wholly black and with large irregular transverse tubercular folds, scarcely arranged in definite lines; prothorax black throughout, as long as wide, very convex, the surface uneven, with four large median depressions forming a square, strongly tuberculose toward the sides, the tubercles posteriorly abruptly elevated, the punctures sparse ; fifth ventral as in *limbatus*. Length 19.0 mm.; width 7.0 mm. Mexico (Amecameca) . . . . *lævicollis*, Sol.

The specimen doubtfully referred to *lævicollis* has the surface of the pronotum rather uneven, and the posterior ridge of the fifth ventral could scarcely be described as "trilobed" ; it is broadly, feebly sinuate, with a long abrupt parallel-sided spur projecting anteriorly from the bottom of the sinus. *Venosus*, of Champion, is peculiar in coloration, having the white indument covering the entire surface, excepting certain black maculation, as in the true *Zopherus ; limbatus* is undoubtedly a very different species, which appears to have been overlooked. Specimens in this genus, as well as the other Zopherini, should be thoroughly soaked for at least a day in benzine before studying, as the exuded grease otherwise completely conceals their ornamentation.

ZOPHERODES, n. gen.

The species of this genus, so far as known to me, are all deep black, without pale ornamentation and with comparatively fine sculpture, the pronotum always punctate. Those in my cabinet may be readily known as follows:

1. Elytra subcylindrical, more abruptly narrowed at base and toward apex; pronotum strongly convex 2
   Elytra evenly oval in outline; pronotum usually less convex 3
2. Pronotal punctures not larger or denser toward the sides. Body moderately stout, dull in lustre, the prothorax as long as wide, angulate at the sides anteriorly, not strongly or muricately, sparsely and evenly punctate, each puncture with a short yellowish seta; elytra rather wider than the prothorax, three-fourths longer than wide, with uneven series of large flattened elevations, the interstices with smaller elevations of the same kind, all with a small setulose puncture at their hind margins. Length 15.0 mm.; width 5.9 mm. Arizona (Gila Valley), Dunn .... *aequalis*, n. sp.
   Pronotal punctures strong but not muricate, uneven in distribution, denser and coarser toward the sides. Body nearly similar, the prothorax less strongly angulate at the sides anteriorly, the surface more coarsely punctate, the elytra not wider than the prothorax, the uneven tuberculose sculpture less definitely lineate; prosternum more clearly, very coarsely punctate; abdomen similarly coarsely punctate. Length 12.0–16.0 mm.; width 4.5–6.4 mm. Arizona.. *tristis*, Lec.
3. Elytra tuberculose 4
   Elytra without tubercles, the surface smooth, alutaceous, with sparse vermiculate incised lines; prosternum tuberculose 11
4. Integuments polished. Form moderately stout, very convex, the prothorax scarcely as long as wide, the sides very feebly angulate before the middle, constricted at base as usual, coarsely, sparsely, irregularly and simply punctate, closely toward the sides; elytra as wide as the prothorax, rather less than twice as long as wide, coarsely, very strongly, closely and more or less irregularly tuberculose; prosternum roughly punctured and tuberculose. Length 14.5–16.5 mm.; width 5.4–6.4 mm. New Mexico .... *concolor*, Lec.
   Integuments more or less dull in lustre 5
5. Elytra but little more than one-half longer than wide. Form stout, the prothorax nearly as long as wide, rounded at the sides, the latter

slightly subangulate before the middle, the surface coarsely, submuricately punctate, only slightly more closely toward the sides; elytra evidently wider than the prothorax, finely, strongly and unevenly tuberculose, the tubercles slightly shining; prosternum irregularly, closely and muricately tuberculose. Length 16.5 mm.; width 7.0 mm. California...... ....*induratus*, Csy.

Elytra at least twice as long as wide in both sexes......... 6

6\. Elytra evidently wider than the prothorax, greatly so in the female. Rather stout, the prothorax fully as long as wide, very coarsely and strongly (♂) or moderately (♀) muricately punctate, the surface (♂) more shining than in the ♀, the punctures slightly closer toward the sides, which are rounded, only slightly prominent before the middle; elytra rather finely but very irregularly, closely tuberculose, the lustre very dull in the ♀, rather shining in the ♂, the sculpture transversely and very unevenly rugulose in the latter; prothorax very unevenly punctato-tuberculose. Length 18.0–19.0 mm.; width 6.9–7.5 mm. California (southern)...*ventriosus*, n. sp.

Elytra never distinctly wider than the prothorax in either sex 7

7\. Elytral tubercles larger, strong, approximating half the thickness of the femora in diameter, arranged more or less definitely in close series 8

Elytral tubercles minute, sometimes very feeble, confusedly arranged.9

8\. Form rather slender, dull in lustre, the prothorax nearly as long as wide, parallel and broadly rounded at the sides, narrowing toward base, strongly, sparsely, non-muricately punctate, more closely and coarsely toward the sides; elytra with the tubercles large, strongly convex and less dull, the interstices densely dull and with small, remote and perfectly simple punctures; prosternum coarsely punctato-tuberculose. Length 17.0 mm.; width 6.2 mm. New Mexico ....*guttulatus*, Horn

Form nearly similar, the pronotum more uneven, with two more or less distinct medial indentations transversely arranged, the punctures coarser muricate, still larger toward the sides; elytra with smaller tubercles, less than half the thickness of the femora in diameter, less opaque than the interstices, which are strongly, muricately punctate; prosternum with small, distinct and sharply elevated tubercles; abdomen finely, sparsely punctate, more strongly toward base. Length 14.5–16.0 mm.; width 5.3–6.2 mm. New Mexico (Fort Wingate), Schufeldt ....*otiosus*, n. sp.

9. Punctures of the pronotum fine, sparse, very faintly muricate, much stronger, closer and muricate toward the sides, without trace of a median impunctate line. Body very slender, dull; prothorax as long as wide, rounded at the sides and slightly prominent just before the middle; elytra moderately opaque, the tubercles moderately small, in mutual contact, extremely feeble in elevation and separated by fine feeble lineiform depressions; prosternum rather finely, acutely tuberculose. Length 15.0 mm.; width 5.0 mm. Arizona... *pudens*, n. sp.

Punctures of the pronotum coarser, strongly muricate, divided along the middle by a more or less incomplete narrow impunctate line ... 10

10. Elytral tubercles in mutual contact, rather strongly elevated and somewhat shining, the incised lines between them fine but distinct; prothorax fully as long as wide, subcordate, coarsely and conspicuously muricato-punctate, very coarsely toward the sides, the latter only very obtusely prominent just before the middle; elytra elongate, each of the small muricate punctures, at the hind margins of the tubercles, bearing a rather distinct yellow seta; prosternum strongly tuberculose. Length 17.5 mm.; width 5.9 mm. Utah (south-western), Weidt........................ *Uteanus*, n. sp.

Elytral tubercles clearly isolated by the densely opaque interstices, very flat but very much more shining than the surface separating them, larger and smaller alternating in very obscure inconstant lines at some parts of the disk; prothorax cordate, fully as long as wide, the punctures strongly muricate but not much larger or closer toward the sides, the latter rounded, only very obtusely prominent before the middle; elytra elongate; general form very slender; prosternum tuberculose. Length 17.0 mm.; width 5.5 mm. Utah.. *Mormon*, n. sp. (Horn, MS.)

Elytral tubercles very small, not larger than the muricate punctures of the pronotum; entire surface very densely opaque as in *Mormon*, the body larger and less slender; prothorax formed nearly as in *Mormon*, the punctures strong and only slightly muricate on the median parts, becoming very coarse and muricate toward the sides; prosternum coarsely, deeply punctate, not tuberculose. Length 18.8 mm.; width 6.5 mm. Utah .... *opacus*, Horn

11. Terminal grooves of the elytra very long, about a fifth of the total length. Body very slender, dull in lustre; prothorax a little longer than wide, the sides nearly straight and subparallel anteriorly,

strongly rounding to the apex and slightly prominent before the middle, thence strongly converging to the base, finely, sparsely punctate, the punctures rather abruptly coarse and slightly muricate near the sides; elytra with minute, sparse and simple punctures, much wrinkled toward base, and with some small tubercles near the humeral angles. Length 16.0 mm.; width 5.5 mm. Arizona .... *caudalis*, n. sp.

Terminal grooves very short as usual........................12

12\. Form very slender in the ♂ and nearly similar in the ♀; prothorax as long as wide, or slightly longer (♂), finely, feebly, rather sparsely and simply punctate, abruptly coarsely, densely and submuricately so very near the lateral edges, the latter converging and straight from the feeble ante-median prominences more than half way to the tip, then rounded to the apex, converging and broadly arcuate toward base; elytra nearly as in *caudalis*, but rather more rugulose. Length 18.0 mm.; width 5.8 mm. Arizona (Grand Canyon of the Colorado)............................*lugubris*, n. sp.

Form moderately slender, larger and less slender than in *lugubris*, similarly dull in lustre; prothorax fully as wide as long, in form and sculpture nearly similar to *lugubris*, but less prominent at the sides just before the middle, and much more tuberculose on the flanks, thence to the base; elytra nearly similar, but with coarser vermiculate impressed lines and shorter, stronger apical tubercles; prosternum much more strongly tuberculose, not evenly as in *lugubris*, but in uneven transverse lines. Length 19.0 mm.; width 6.6 mm. Arizona (Grand Canyon of the Colorado), T. Mitchell Prudden.... *Pruddeni*, n. sp.

Form stouter and more parallel than the two preceding, and less constricted at the junction of the elytra and prothorax, the latter nearly as in *lugubris*, but with less converging straight sides anteriorly, which are more abruptly and briefly rounded to the apex at tip; similarly converging and arcuate, with the flanks tuberculose, posteriorly; surface minutely, sparsely, simply punctate, the punctures not noticeably coarser or denser toward the sides, except slightly along the immediate subprominent edge anteriorly; elytra somewhat flattened above, almost smooth but dull as usual, with a few fine tubercles near the humeral angles. Length 20.0 mm.; width 7.0 mm. Arizona ....*luctuosus*, n. sp.

The species described by Horn under the name *granicollis* is not at hand at present, and therefore cannot be inserted at its proper place in the table; it is distinctly isolated in sculpture and can be readily identified from the original description. *Gracilis* Horn, is also unique as far as known; it may be distinguished from *caudalis* and allies by its shining surface and punctured, not tuberculate, prosternum. *Elegans* may be provisionally attached to this genus, as before remarked.

PHLŒODES, Lec.

Of the two described species of this genus, *diabolicus*, inhabiting the more northern regions of California, has dense pale vestiture on the apical declivity of the elytra, while *pustulosus*, Lec., from San Diego, has no pale incrustation, and is a much larger insect. The species or subspecies are rather numerous, and those in my cabinet may be described in outline as follows:

1. Elytra with more or less pale vestiture on the apical declivity 2
   Elytra without paler vestiture at apex 4
2. Form stout, the prothorax as wide as long, very nearly as wide as the elytra; velvety spot at the middle and base of each elytron small and very inconspicuous; whitish vestiture forming a large solid patch at each side of the apical declivity. Length 16.0–19.5 mm.; width 6.4–7.5 mm. California (Mt. Diablo) ....*diabolicus*, Lec.
   Form slender 3
3. Prothorax slightly longer than wide, sculptured nearly as in *diabolicus*, the head with small tubercles throughout, and not sparsely tuberculose at the middle of the vertex as in that species; elytra oval, only very slightly wider than the prothorax, the pale vestiture more diffused between the rugosities of the apical declivity, the central velvety spot slightly arcuate and oblique, the basal short. Length 14.0-16.0 mm.; width 5.4–6.2 mm. California, Cab. Levette......
   ovipennis, n. sp.
   Prothorax distinctly elongate, the finer tubercles aggregated in two longitudinal sinuous median lines more obviously than in *diabolicus*, the head covered throughout with small tubercles which are close-set, and, as in *ovipennis*, densely punctulate on their convex surfaces; elytra oblong-oval, with the pale vestiture confined to the apical parts of the declivity, the velvety spots large and distinct, the basal much elongated. Length 17.0 mm.; width 6.4 mm. California (Kern Co.)
   elongatus, n. sp.

4. Prothorax as wide as the elytra (♂) or nearly so (♀); sculpture very rugose; colour deep black throughout; elytra oblong; anterior femora tuberculose. Length 19.0–22.5 mm.; width 7.4–8.8 mm. California (San Diego) . . . . *pustulosus*, Lec.
   Prothorax much narrower than the elytra 5
5. Pronotum rather strongly elevated along median third; body rather narrow, elongate; prothorax longer than wide, the slopes of the median elevation slightly concave and devoid of tubercles, the latter close along the sides of the elevation; elytra evenly oval, about two-thirds longer than wide, rugose as usual. Length 19.5 mm.; width 7.2 mm. California (near San Diego), Dunn. . . . *scaber*, n. sp.
   Pronotum but feebly elevated along the middle 6
6. Elytra oblong, about one-half longer than wide, deeply and roughly sculptured, with the velvety spots well developed: prothorax slightly longer than wide, strongly and rather closely though unevenly tuberculose over the entire surface. Length 20.0 mm.; width 7.8 mm. California, Cab. Levette . . . . *latipennis*, n. sp.
   Elytra oval, much narrower and more elongate, nearly three-fourths longer than wide, scabrous as usual, the velvety spots indistinct; prothorax narrower and still more elongate, very unevenly and more sparsely tuberculose, with large areas along the middle and lateral third devoid of tubercles; body much more elongate and narrower in form. Length 19.5 mm.; width 7.2 mm. California, Cab. Levette. . . . . *angustus*, n. sp.

The forms above enumerated are mutually very similar in facies and sculpture and may prove to be subspecies of a single stock, but they are at least recognizable.

NOSERUS, Lec.

The three species in my cabinet may be known by the following characters:

1. Prothorax evenly cordate, narrowed behind from near the apex 2
   Prothorax parallel and rounded at the sides, narrowed posteriorly only behind the middle 3
2. Body broad in form, the prothorax slightly longer than wide, scarcely at all convex, irregularly tuberculose and uneven, with two longitudinal ridges, angulate toward the median line, especially evident; elytra slightly wider than the prothorax, oblong, flattened above, rapidly declivous at the sides, each with three large tumidities on

the strongly declivous apex, one oblique just behind the middle and a short longitudinal median ridge basally, the ground surface finely, sparsely tuberculose. Length 15.5–16.0 mm.; width 6.3 mm. California (Monterey), Dunn.....................*plicatus*, Lec.

Body nearly similar but much smaller and relatively narrower, the elongate prothorax with coarser tubercles toward the sides and finer and sparser elsewhere, the inequalities of the surface nearly as in *plicatus*, but with the elevations more pronounced; elytra not (♂) or but slightly (♀) wider than the prothorax, with the principal elevations nearly as in *plicatus*, but with the ground surface more coarsely pitted and still more minutely tuberculose. Length 14.0–15.5 mm.; width 4.7–5.7 mm. California, Cab. Levette...... *torvus*, n. sp.

3. Form relatively broader and more parallel, the prothorax less narrowed at base, flat above, and not longer than wide, with many unevenly disposed tubercles, the elevations of the same general form as in the two preceding but very much feebler; elytra not wider than the prothorax, scarcely more than one-half longer than wide, sculptured nearly as in the preceding, the longitudinal basal ridge more acutely elevated. Length 16.0 mm.; width 6.2 mm. California, Cab. Levette......................................*collaris*, n. sp.

The species described by G. H. Horn under the name *emarginatus* I have not seen; it occurs in Texas. *Noserus* greatly resembles *Nosoderma* in facies, but differs in its slightly grooved tarsi, and in having a feeble antennal groove anteriorly.

PHELLOPSIS, Lec.

This genus resembles *Nosoderma* in having the tarsi not grooved and the antennal cavities wholly wanting, but differs greatly in facies and in having eleven free antennal joints. Dr. Horn surmises in the "Classification," that *porcata*, of LeConte, may be only a variety of *obcordata*, Kirby, and it is so indicated in the Henshaw list, but the two forms are in reality well differentiated species. The four species in my cabinet may be readily known as follows:

1. Outer of the two discal ridges of each elytron obsolete at about a fourth of the total length of the elytra from the base; sides of the elytra parallel 2

Outer ridge obsolete much nearer the base, this distance being a sixth or seventh of the total length; sides of the elytra feebly converging from the rounded humeri to the subapical tumidity 4

2. Elytra much more than twice as long as wide, the general form more slender, with a relatively somewhat smaller prothorax, the sides of which are subparallel for more than half the length from the apex, then strongly converging to the base, the surface uneven, with an elevation at each side near the middle and a large elongate-oval median elevation in basal two-thirds, which is concave anteriorly and deeply foveate at base, the tubercles of the general surface moderate, not parted along the median line at the centre of the pronotum; elytra each with two discal ridges and three strong subapical tumidities, coarsely foveato-punctate in series. Length 12.0–13.5 mm.; width 4.2–4.9 mm. Oregon.........*porcata*, Lec.

Elytra together twice as long as wide 3

3. Body nearly similar throughout to *porcata* but very much stouter, the elytral punctures more shallow and obscure, the pronotum with very coarse tubercles anteriorly, the basal pubescent fovea of *porcata* replaced by a short nude sulcus, the central part of the disk not sulcate, but more coarsely tuberculose than in *porcata;* elytra nearly similar, except that the outer of the three subapical tumors is very much smaller and less prominent. Length 14.5 mm.; width 5.5 mm. Idaho (Cœur d'Alene)........................*robustula*, n. sp.

Body stouter than in *porcata*, the prothorax rounded and subprominent at the sides anteriorly, more strongly narrowed posteriorly from the middle or still more anteriorly; elevations of the surface nearly as in *porcata*, but with the oval central inclosure much more open anteriorly and with very large tubercles ranged in series along a narrow nude longitudinal sulcus at the centre of the pronotal disk; subapical tumors of the elytra large and conspicuous; elytra nearly similar but with much deeper, more perforate and distinct serial foveæ. Length 10.8–14.0 mm.; width 3.9–5.1 mm. New Hampshire (White Mts.) and Pennsylvania ....*obcordata*, Kirby

4. Body generally similar to the preceding but with the prothorax rounded at the sides anteriorly and moderately narrowed in basal two-fifths, the general surface flatter, with less prominent elevations, the median basal oval elevation much shorter, not extending before the middle, with a narrow sulciform fovea at the centre of the pronotal disk, and a larger and more rounded pit at the base; tubercles throughout strong and distinct; elytra with the inner of the longitudinal ridges less obliterated behind basal fourth, almost

continuous, the punctiform serial foveæ smaller, the lateral subapical tumors rather smaller and less prominent than in *porcata* and *obcordata*, but much more so than in *robustula*. Length 12.0–14.5 mm.; width 4.5–5.4 mm. California (Placer Co. and Lake Tahoe).. *montana*, n. sp.

Other species of this genus probably exist in collections.

ENTOMOLOGICAL SOCIETY OF AMERICA.

The initial meeting of the Entomological Society of America was held in the American Museum of Natural History at New York City, Dec. 28, 1906.

On the evening of December 28, Prof. Wm. M. Wheeler delivered before the Society an illustrated lecture on "The Polymorphism of Insects." Immediately after the lecture the business meeting took place. Prof. J. H. Comstock, of Ithaca, N. Y., was elected chairman, and E. S. G. Titus, of Washington, D. C., secretary of the meeting. The new Society then adopted a constitution and by-laws, and elected officers and the other members of the Executive Committee.

The following are the officers: President, J. H. Comstock, Ithaca, N. Y.; 1st Vice-President, James Fletcher, Ottawa, Can.; 2nd Vice-President, Henry Skinner, Philadelphia, Pa.; Sec.-Treasurer, J. Chester Bradley, Berkeley, Cal.

The Executive Committee consists of the officers and the following: Wm. M. Wheeler, New York, N. Y.; John B. Smith, New Brunswick, N. J.; Herbert Osborn, Columbus, O.; C. J. S. Bethune, Guelph, Can.; F. M. Webster, Washington, D. C.; and Chas. W. Johnson, Boston, Mass.

Following the business meeting, there was a smoker at the Hotel Endicott, given by the Brooklyn, Newark and New York Entomological Societies to the Association of Economic Entomologists and the Entomological Society of America.

The Executive Committee, at a meeting held December 29, decided to call a meeting of the Society at Boston, Mass., in connection with the meetings of the International Congress of Zoology in August, 1907. Full announcement will be made later.

All persons interested in entomology, and residing anywhere in the Americas, are invited to apply for membership. The dues are one dollar a year. The membership now exceeds 250. The American Association for the Advancement of Science granted affiliation to the new Society at their New York meeting. E. S. G. Titus, Secretary.

ON THE CLASSIFICATION OF THE MOSQUITOES.

BY HARRISON G. DYAR AND FREDERICK KNAB.

Now that Professor Williston has cleared the ground and destroyed the Theobaldian classification of Culicidæ, let us try a little constructive work. We regard it as essential that all the groups, both generic and higher, should be based only on characters found in both sexes of the adults; that these characters should be fundamental as generally recognized by systematists, and that they should be supported by sound larval characters. We have only one cause of difference with Prof. Williston's remarks, namely, his implied statement that the palpal characters are of value in generic definition. They are not, in the case of the mosquitoes. The differences consist in varying length and the number of joints. They seem at first sight interesting, and we were much attracted to them on beginning our generic studies. But they prove to be entirely secondary sexual characters, not correspondingly represented in both sexes, and are, therefore, ruled out. Moreover, the small terminal joint or joints of the female palpi, on the presence or absence of which Neveu-Lemaire's classification is based, is variable within the limits of a single species (*Culex tarsalis*, Coq.), and is gradually evanescent in another series of species (*Ædes*, spp.), besides there being no modification in the male to correspond with it. The long palpi of the male have been developed independently in several groups (the short palpi being the generalized condition), and are therefore a parallel development without fundamental value. Therefore, the old classification, which Prof. Williston advises his readers to retain, is unsound, as it is based on these palpal characters. We may remark that the same condition appears to obtain in the Tipulidæ, since Loew says, speaking of the division of the family on the long and short palpi: "The division, indeed, is no natural one" (Dipt. No. Am., 10, 1862).

All the subfamilies of the Culicidæ recognized by the Theobaldian school are untenable, including the Anophelinæ. We have found only two subfamilies, the Culicinæ and Sabethinæ. We will not quarrel with Prof. Williston over the terminology, but hasten to call them tribes. The Culicini, then, have the metanotum devoid of setæ; the larvæ furnished with a median ventral brush on the anal segment; the Sabethini have a group of setæ on the metanotum, and the larvæ without a ventral brush on the anal segment. These are primary and essential divisions, the two groups showing a general dissimilarity in their appearance and habits, both as adults and larvæ, beside the structural points noted.

In tabular form we recognize the following genera. We have employed one new character, the tibial comb or scraper, a microscopic structure situated at the end of the tibiæ, and consisting of a row of fine spines. It apparently functions as a cleansing organ for the body parts or wings.

CULICINI.

1. Scutellum evenly rounded, not lobed .... 2.
   Scutellum distinctly trilobed .... 3.
2. First submarginal cell longer than its petiole .... *Anopheles.*
   First submarginal cell less than half as long as its petiole . *Megarhinus.*
3. Hind tibial scraper with a row of 7 to 12 closely set setæ .... 4.
   Hind tibial scraper with none to 5 sparsely set setæ .... 13.
4. Scutellum with central lobe elongate, collar-like, not tubercularly prominent .... 5.
   Scutellum with central lobe distinctly prominent and tubercular ... 6.
5. Terminal antennal joints slender, long .... *Mansonia.*
   Terminal antennal joints short, broad .... *Ædeomyia.*
6. Second joint of antennæ very long, 14 x 1 .... *Deinocerites.*
   Second joint of antennæ moderate, less than 8 x 1 .... 7.
7. First submarginal cell less than half as long as its petiole. *Uranotænia.*
   First submarginal cell at least nearly as long as its petiole .. .... 8.
8. Head with a distinct neck, the occiput broad and exposed .... *Psorophora.*
   Head without a distinct neck, appressed to the thorax .... 9.
9. Cross veins tending to lie in line, the third separated from the second by less than its own length .... *Culiseta.*
   Cross veins normal, widely separated, the third distinct from the second by its own length .... 10.
10. ♀ with the last segment of the abdomen not extensile, large, squarely ended; ♂ genitalia with the harpes slender, columnar with bent spined tip .... *Tæniorhynchus.*
    ♀ with the last segment of the abdomen extensile, slender; ♂ genitalia with harpes broad, concavely curved .... 11.
11. Clypeus bare .... 12.
    Clypeus with dense appressed scales .... *Stegomyia.*
12. Prothoracic lobes approximate .... *Hæmagogus.*
    Prothoracic lobes well separated .... *Ædes.*
13. Feet with large empodia .... *Lutzia.*
    Feet with small empodia .... *Culex.*

SABETHINI.

1. Clypeus without hairs .... 2.
Clypeus hairy on the sides .... *Joblotia.*
2. Prothoracic lobes contiguous, densely hairy .... *Sabethes.*
Prothoracic lobes well separated .... 3.
3. Eyes separated by a narrow wedge; proboscis rather short, swollen at tip .... 4.
Eyes contiguous on vertex .... 5.
4. Claws of hind tarsi two, normal .... *Wyeomyia.*
Hind tarsi with but a single claw .... *Limatus.*
5. No erect forked scales on occiput; proboscis longer than the body .... *Phoniomyia.*
With a row of erect forked scales on occiput; proboscis not longer than body .... 6.
6. Front of head normal, smooth .... *Lesticocampa.*
Front with a conical process above the clypeus .... *Runchomyia.*

List of American genera, with principal synonyms.

Anopheles, Meigen.
- *Myzomyia*, Blanch.
- *Cycloleppteron*, Theob.
- *Nototricha*, Coq.
- *Cellia*, Theob.
- *Arribalzagia*, Theob.
- *Cœlodiazesis*, D. & K.

Megarhinus, R.-D.
Mansonia, Blanch.
- *Pneumaculex*, Dyar.

Ædeomyia, Theob.
Deinocerites, Theob.
Uranotænia, Arrib.
Psorophora, R.-D.
Culiseta, Felt.
- *Theobaldinella*, Blanch.

Tæniorhynchus, Arrib.
- *Coquillettidia*, Dyar.

Ædes, Meig.
- *Ochlerotatus*, Arrib.
- *Heteronycha*, Arrib.
- *Janthinosoma*, Arrib.
- *Conchyliastes*, Coq.
- *Grabhamia*, Theob.
- *Howardina*, Theob.
- *Culiselsa*, Felt.
- *Culicada*, Felt.
- *Ecculex*, Felt.
- *Protoculex*, Felt.
- *Pseudoculex*, Dyar.
- *Gymnometopa*, Coq.
- *Lepidoplatys*, Coq.
- *Feltidia*, Dyar.
- *Ceratocystia*, D. & K.

Hæmagogus, Will.
- *Cacomyia*, Coq.
- *Stegoconops*, Lutz.

Stegomyia, Theob.
Lutzia, Theob.
Culex, Linn.
- *Neoculex*, Dyar.
- *Culicella*, Felt.
- *Melanoconion*, Theob.
- *Tinolestes*, Coq.

Micraedes, Coq.
Isostomyia, Coq.
Mochlostyrax, D. & K.
Sabethes, R.-D.
Sabethoides, Theob.
Wyeomyia, Theob.
Dendromyia, Theob.
Limatus, Theob.
Simondella, Laveran.
Phoniomyia, Theob.
Lesticocampa, D. & K.
Runchomyia, Theob.
Joblotia, Blanchard.
Trichoprosopon, Theob.

A NEW SPECIES OF MEGARHINUS.

BY FREDERICK KNAB, WASHINGTON, D. C.

A small lot of mosquitoes which were recently received from Dr. W. F. Thornton, of Bluefields, Nicaragua, contains a single specimen of a *Megarhinus*, which represents a new species. It is related to the forms with white-ringed tarsi, recently dealt with in a paper by Dr. Dyar and myself (Smithonian Miscellaneous Collections, Quarterly Issue, xlviii, 241–258, 1906), but differs from all the known species in that the white on the hind tarsi does not encircle them, but is upon the outer side only.

Microscopic preparations show that the so-called second and third segments of the male palpus are really one, being only apparently divided by a false joint, a slight constriction accentuated by a difference in the coloration of the scales. The male palpus is, therefore, only four-jointed, consisting of a very short basal joint, a very long second joint (apparently homologous with the third joint of the males of the Culicine and Anopheline forms), a third shorter joint, and a fourth long and sabre-like. In the female there is a fifth very minute terminal joint, hidden beneath a dense vestiture of scales. What has been called the first abdominal segment in previous descriptions is in reality the post-scutellum, which overlaps the basal portion of the abdomen. In the following description, for the sake of uniformity, the palpi are treated as in previous descriptions.

Megarhinus hypoptes, new species.—Male: Head behind the eyes velvety-black, the eyes broadly bordered with light metallic-blue, beneath and at the sides silvery. Antennæ densely plumose; the toruli with silvery lustre; second segment long and stout, longer than the three succeeding ones, somewhat compressed laterally, the heavy scaling of the crest condensed to a prominent iridescent blue patch on the anterior portion. Palpi metallic-blue and purple, segments 2 to 4 pale lilac at the tip, second and fourth segments nearly equal, the third longer, fifth twice as long as the fourth. Prothoracic lobes deep metallic-blue. Mesothorax greenish-black on the disk, with a few coppery scales intermixed; the anterior and

posterior margins, an ill-defined median line and patches at the middle of the sides metallic-blue. Scutellum and post-scutellum bright metallic-blue. Pleura and coxæ silvery. Abdomen above deep blue, passing from greenish to a violaceous-tinge towards the tip, segments 6, 7 and 8 marked with gold at the hind angles, the seventh with a fine golden hind margin. Claspers violet-scaled. Sixth and seventh segments laterally expanded, reaching their greatest width at the tip of the seventh. No caudal tufts. Lateral abdominal cilia pale on all the segments but the last, dark on the eighth and the genitalia. Abdomen beneath yellowish-silvery, with a median blue stripe. The stripe is widest on the third and fourth segments, and narrows to a fine line on the sixth and seventh. Eighth segment violaceous beneath, tipped with gold. Legs deep violet and blue, the hind tarsi only white-marked. Under surface of the femora bright brassy. On the hind legs the fourth and fifth tarsal joints are silvery-white on the outer side, black on the inner. Length, 9.5 mm. (exclusive of appendages).

Type.—Cat. No. 10, 146, U. S. Nat. Mus.

Locality.—Bluefields, Nicaragua. (W. F. Thornton.)

TWO NEW BEES OF THE GENUS TRIEPEOLUS.

BY T. D. A. COCKERELL, BOULDER, COLO.

Triepeolus grindeliæ, n. sp.—♀. Length 10–11 mm.; black, the legs red, with black spurs; pubescence pale cinereous, with a slight yellow tint. Wings nearly clear; tegulæ orange ferruginous; mesothorax with two short longitudinal bands of pubescence; antennæ black except the third joint and extreme base of fourth, which are dull red; clypeus with very dense minute punctures, and scattered larger ones; labrum black; mandibles largely red; lower part of pleura bare, densely punctured; scutellum rather prominent, bilobed; lateral teeth black, short but rather sharp; broad apical bands on abdominal segments 1 to 4 entire; transverse black area on first segment as in *helianthi*, *occidentalis*, etc; oblique patches at sides of second segment pointed, and making an angle of about 45° with apical band; apical segment reddened; pygidial area large and circular; last ventral segment curved downwards at apex. By the shape of the last ventral segment, and the comparatively small size, it is allied only to the Californian *T. callopus*, Ckll., from which it differs by the larger size, grayer pubescence, circular (instead of oval) pygidial area, black labrum, more strongly bilobed scutellum, etc.

Hab.—Boulder, Colorado, three at flowers of *Grindelia*, Aug. 7, 1906 (W. P. Cockerell).

Triepeolus Eldredi, n. sp.—♂. Length, 12 mm.; black, including the legs; but the small joints of the tarsi are dark reddish, and there is a bright ferruginous patch on the flagellum in front near the base, occupying parts of the third and fourth antennal segments; pubescence of thorax and abdomen above dull creamy, but of face, pleura and legs silvery-white; mandibles with a reddish median spot; labrum black; face and nearly all of clypeus covered with shining silvery hair; pleura entirely covered with hair; mesothorax dull and rough, deeply longitudinally sulcate, with a reniform black area, which is joined to the margin by a black band anteriorly; anterior part of mesothorax with a transverse band of light hair, but there is a narrow black area between this and the prothorax; tegulæ black, punctured; third submarginal cell very broad above; scutellum bigibbous, the lateral teeth very small; abdomen 6-banded, the last one whiter than the others; black area on first segment a transverse band; bands on first and second segments quite entire; band on second segment with a lobular projection at each extreme side, but this projection is not so high as the width of the band, and is not at all directed inwards. Very close to *T. Wyomingensis*, Ckll., but differs from that species by the broad, clean-cut transverse black band on first abdominal segment, the third s. m. wider above, the broader and flatter scutellum, the duller mesothorax and tegulæ, the pleura covered with hair, and the red spot on the antennæ.

Hab.—N. Yakima, Washington State, Aug. 7, 1903 (Eldred Jenne).

ENTOMOLOGICAL SOCIETY OF ONTARIO.

MONTREAL BRANCH.

Three meetings have been held since the summer recess, one during each month. At these the members exhibited their summer catches, and discussed them with each other. A certain genus was set aside at each meeting for comparison, and we have had discussions on Xylina, Acronycta and Datana, the members exhibiting any specimens that they had obtained; Mr. Lyman gave his experience with each genus, and helped to clear up some of the difficulties. Mr. Chagnon read papers on Coleoptera, particularly one on the genus Chrysobothris, and exhibited all of the known Canadian species. Mr. Denny read a paper on "Collecting Catocalas in the daytime," and exhibited a number of specimens that he had taken. Mr. Moore reported on Hemiptera taken at Como, P. Q., during the past summer, and exhibited specimens. GEO. A. MOORE.

NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

(Continued from page 9.)

Eucosma fuscana, sp. nov.—Expanse, 23 to 30 mm. Head, palpi, thorax and fore wings, brownish-fuscous, finely irrorated with whitish scales; basal area darker, in middle extends two-fifths length of wing.

Head rough, tuft on second joint of palpi flatly triangular, extending below beyond third joint, latter only exposed from above. Head, palpi and thorax grayish brown or brownish-fuscous, finely and closely irrorated with whitish scales, the tip or outer end of each scale is whitish. Abdomen whitish-cinereous, anal tuft cinereous, speckled with white. Legs cinereous, speckled with fuscous, fronts of femora and tibiæ of anterior pair brownish-fuscous.

Fore wing brownish-fuscous, finely and closely irrorated with whitish. The white irrorations are not evenly spread over the entire surface, their absence or partial absence in some places forms darker area; the most prominent of the dark shade is the basal area, which on the dorsum reaches beyond inner third, thence obliquely and somewhat concave to middle of wing at two-fifths from base, above the middle from base to apex the upper half is evenly irrorated, hence the basal dark area is only sharply defined on the dorsal half of wing. At outer third is a more or less obsolete darker angulated fascia; from dorsal margin in the form of a narrow bar pointing toward middle of termen, but in length less than one-third the width of wing, directly above it a similar bar reaches to upper edge of cell; between this outer fascia and dark basal area the white irrorations are thickest, giving the appearance of a paler fascia between these darker shades. Paralleling the termen the white irrorations are arranged in irregular and broken lines. Male costal fold narrow, about one-third length of wing, appressed and darker brown. Cilia same as outer end of wing.

Hind wing above and beneath, and cilia uniformly pale fuscous.

Under side fore wing, same shade of brownish-fuscous as above, but without the paler irrorations.

Four specimens: Rounthwaite, Manitoba, July, Marmont; Iowa, Ac. Cat., No. 182, C. P. Gillette; Chicago, Illinois, C. H. Fernald, and one specimen from Prof. Fernald, bearing label "10733, Aug. 31," but no locality.

Co-types in U. S. Nat. Mus., Prof. Fernald's and in my collection. In the four specimens before me quite a little variation is observable,

caused by the more or less density of the white irrorations, in one specimen the basal dark area can hardly be defined.

Eucosma bilineana, sp. nov.—Expanse, ♂, 24 to 30 mm.; ♀, 32 mm. Fore wing pale clayish-ochre, with two horizontal black lines, one from base to middle, and one above it from middle to apex, the latter divided and more or less diffused on its outer half.

Head rough, dull brown in front, shading into ochreish-brown on top. Palpi flattened, ovate, scales neither compressed nor loosely laid, apical joint exposed above, but hidden below by projecting tuft from second joint; colour pale ochreish, darker on outer sides and below, apex brown. Antennæ ochreish, lightly ciliated in both ♂ and ♀. Thorax whitish-ochreous, shading into dark brownish-ochreous anteriorly. Abdomen and legs cinereous, tarsi and tibiæ marked and dotted with dark brown.

Fore wing pale, terra-cotta or clayish-ochre; palest along dorsal margin, and overlaid with a deeper ochreous shade along costa and outer third. A narrow black line through middle of wing from just beyond base, nearly to end of cell, where it diminishes to a hair streak and follows vein ii nearly to angle. Above the outer end of the thickened part of this line, at two-thirds length of cell, another wide line begins, and continues to end of cell, where a narrow spur from its up edge continues in termen just below apex; the inner end of this line is somewhat clavate, beyond its outer end, below the apical spur, is a cloud of whitish, dark brown and ochreous scales, between veins v and vii, and over the latter line is a second spur of black scales, but much broken. The costal fold is nearly half the length of wing, closely appressed at base, but rolled over at its outer end; colour, ground colour, but of a more sombre hue; costa beyond fold pale ochreous, with five evenly-spaced black dots, below these are five or six other black dots, not evenly spaced. On the dorsal margin are about the same number of black dots, closer together about the middle. A row of similar dots along the termen, and a few others scattered over the wing, several in the ocellic space, one below outer end of second horizontal line, and a faint line below and paralleling the inner half of the inner line. Cilia grayish-fuscous, paler basally and mottled with darker fuscous scales. Hind wing above and below smoky-ochreous, cilia paler. Under side fore wing smoky-fuscous, paler along costa, where the dark costal dots are repeated. Cilia paler. The above description is from an average ♂, in other specimens the intensity of the dark lines and dots are less or greater. In one ♂ specimen the dark markings are nearly obsolete, leaving only a faint basal and faint outer line, no dots at all, while

in another the dark marks are intensified and the whole outer upper half of wing is clouded with dark scales; the outer end of the outer line divides into three distinct lines or spurs.

I have but one ♀, which differs considerably from the ♂. All of the head, palpi and thorax colouring is much darker. The fore wing is a dull brown, overlaid on lower half below cell with whitish-gray scales, a line of these same scales are above and join the internal black line, and above this is a parallel line of gray-white scales, all the veins beyond the cell are overlaid with the same, and the intervening spaces rather closely speckled with them. The outer black line with its spurs is obsolete, but three or four black dots remain on outer half of costa, and a cluster of black dots on the ocellic space, of which four are in a vertical row along termen and three or four before them.

Seven ♂ and one ♀ specimens. West Manitoba, July, Hanham; Illinois, Prof. Fernald; Iowa, U. S. Nat. Mus. Ac. Cat. No. 383.

Co-types in U. S. Nat. Mus., Prof. Fernald's and my collections.

Eucosma madderana, sp. nov.—Expanse, 13 to 14 mm. Fore wing grayish-white. A large rounded brown-madder spot on outer end of wing, interior of wing washed with fainter shades of this same colour, especially over the basal area, and an oblique semi-fascia from costa beyond middle.

Head rough, rose-madder, palpi same, but a shade darker above and outwardly, tuft compressed, flattened, ovate; outer joint not hidden, brown. Antennæ cinereous, annulated with a darker shade. Thorax smooth, light brown-madder, posteriorly and tips of patagia paler. Abdomen pale fuscous, anal tuft cinereous. Legs steely-fuscous, tibiæ and tarsi streaked and spotted with brown-madder.

Fore wing grayish-white, this ground colour is only distinct before the ovate terminal spot and on dorsal margin before ocellic space, on the latter space it is overlaid with darker scales. Basal area, which extends to inner third at middle and inner fourth on costal and dorsal margins, is a light pink-madder. From the costa just at and beyond middle, an oblique flattened ovate spot on fascia of brown-madder crosses wing towards anal angle, but terminates in a pointed end at vein iii. Between this spot and basal area the colour is a rosy-madder over the gray-white ground. A large, ovate brown-madder spot, its outer margin involving the termen from anal angle to apex, its inner margin curving easily inward from angle to end of cell, then outward to costa before apex; veins iv to viii where they cross this patch are overlaid with fuscous-brown, and where

each terminates on margin are a few yellowish scales, between these is a dark line on the termen, before the cilia.

Costal fold narrow, not closely appressed, about one-third length of wing, colour brown-madder. Costa beyond fold same colours as fascia and patches that touch it. Before the ovate terminal spot the ground colour is the whitest of any part of the wing, and offers a sharp contrast to the dark outer spot; it is divided by a line of madder scales. Cilia grayish-white, tipped with fuscous.

Hing wing pale smoky-fuscous, slightly darker at apex, where a few darker scales form a dot; cilia paler, preceded by a darker, then a paler line. Under side same, but darker.

Under side fore wing dark smoky-fuscous, dark scales more intense at apex, shading narrowly into madder on costa before and at apex; cilia gray, preceded by a darker and paler line, an additional faint narrow dark line precedes these ciliate lines on the termen.

Four specimens. Rounthwaite, July, Marmont; West Manitoba, Hanham; Ottawa, Quebec, vi, 26; Regina, Assiniboia, Willing.

Type in my collection.

Eucosma Heathiana, sp. nov.—Expanse, 17 to 18 mm. Fore wing cream-white, with a dark fuscous dorsal blotch below fold, not touching base and ending before ocellic spot.

Head, frontal tuft pure white, tuft between eyes tinged with very pale brown in some specimens, in others pure white. Palpi pure white, second joint loosely clothed below and above. Scales below longer than above, and the ends almost concealing tip at outer joint, which is obtuse and cream-white. Antennæ white, annulated with light fuscous. Thorax smooth, white, posteriorly stained with fuscous, this darker shade concentrated in form of a dark dot on each side of dorsal line. Abdomen and legs cream-white, tarsi annulated with fuscous.

Fore wing cream-white, a conspicuous dark fuscous blotch occupies all the space between fold and dorsal margin, except at extreme base and ocellic spot. In the most strongly-marked specimens the dark shade is sharply defined by the line of the fold as far as end of cell, beyond it slightly swells upward, terminating in a rounded spot before the ocellic space. In less strongly-marked specimens the white ground colour more or less overlaps the fold, reducing the width of the dark blotch. This fuscous blotch is more or less overlaid with black scales; the latter are more frequent in the rounded process at the outer end. Costa from ♂ fold to apex dotted with about ten brownish to black short dashes, nearly

evenly spaced; from each alternate dash a dark-cream or pale-brown line runs obliquely towards termen, the first merging into second before reaching termen, the three outer ones merging and reaching termen just below apex; the lines are nearly obsolete in some specimens. Between these lines, along costa, the white ground colour has a shining iridescent appearance. The ocellic spot is of the same shining white, enclosing a cream or very pale-brown centre, and contains three short, horizontal black dashes, vertical to each other, with two similar black dashes before the ocellus. These black dashes are easily removed, in some slightly rubbed specimens. Some or all are entirely missing. Cilia cream-white, thickly powdered with dark-gray atoms. Hind wing, above and beneath, very pale fuscous, cilia white, with a faint fuscous line beyond base.

Under side fore wing shining brassy-fuscous, costa narrowly white, cilia cream-white.

Eleven specimens, ♂ and ♀. Cartwright, Manitoba, E. Firmstone Heath; Washington Co., Arkansas, July and August, A. J. Brown. I take much pleasure in dedicating this species to the Dean of our Canadian entomologists. The species is one of the strongly protected kind, and doubtless when at rest on a leaf, with wings folded, it as closely resembles a bird-dropping as the well-known *Stenoma Schlægeri*, Zell., which it superficially resembles.

Co-types: Mr. Heath's and my collection.

Thiodia ochrotermenana, sp. nov.—Expanse, 11 to 15.5 mm. Fore wing, inner three-quarters mottled black, ocellic spot and termen, including apex, dull ochreous.

Head rough, brownish-ochreous. Palpi flattened, compressed, third joint not exposed, brownish-ochreous, stained with darker brown in front and below, and streaks of same colour on outer sides towards base. Antennæ, basal joints light brown, outer joints dentate in ♂, simple in ♀, dark fuscous.

Thorax ochreous-brown anteriorly, patagia same, a dark brown streak on posterior half of thorax. Abdomen cinereous, anal tuft clearer yellow. Legs cinereous, tibiæ and tarsi annulated and streaked with blackish-brown.

Fore wing, inner two-thirds to three-quarters dull black, flecked with a few brown scales, and with darker-black lines, like watered silk. A few brown scales at extreme base, a few about middle of wing on lower half, and two paler spots on costa beyond middle, each enclosing a darker dot. The ocellic space and above it to apex, including the cilia, is dull ochreous.

This ochreous shade begins on costa about one-sixth before apex, as a light ochreous spot with black centre, the division line continues obliquely inward nearly to end of cell, thence to dorsal margin, which it reaches at outer three-quarters; the internal boundary on the lower half is dark brown, the ocellic space beyond is defined by a large U-shaped mark of shining ochreous scales, a narrow horizontal bar and a few black specks of black cross this space, above it, to costa, the ochreous colour is paler than the colour of extreme termen and cilia, but is more or less mottled with shining as well as darker scales. The extreme edge of costa, when viewed from the front, is ochreous its entire length, but interrupted by numerous black scales. The basal area is not defined. Hind wing smoky cinereous, darker towards apex and termen, cilia paler, preceded by a darker, then by a paler line; beneath cinereous. Fore wing beneath smoky black, with four geminated ochreous spots on outer half, and a few single spots of same colour on inner half of costa. Gray below the fold. Cilia ochreous, and a few ochreous scales are scattered along the termen.

Thirty-five specimens, ♂ and ♀. Rounthwaite, Manitoba, July, Marmont; Montreal, viii, 15, A. F. Winn; Chicago, Ills., September, J. H. Reading; Winchenden, Mass., ix, 1, and New Brighton, Pa., viii, 6 to 10, F. A. Merrick; Nicholson, Pa., viii, 5, A. E. Lister; Plummer's Isl., Md., viii, 10, A. Busck; Montclair and Essex Co., N. J., viii, 20 to 26, Kearfott.

Co-types: U. S. Nat. Mus., and in collections of Merrick, Lister and Kearfott.

Proteopteryx Criddleana, sp. nov.—Expanse, 13 to 17 mm. Fore wing whitish-gray, with a bold blackish-gray basal area, sharply angulated outwardly, and a shade of dark colour from end of cell to apex.

Head gray, speckled with fuscous above, face white, palpi, tuft on second joint flattened, rounded above and below, outer half of third joint exposed; whitish-gray, speckled with fuscous above and on outer sides, a strong streak of blackish through middle of tuft from base on the outer side. Antennæ grayish, annulated with fuscous. Thorax smooth, gray, heavily overlaid with black scales in some specimens, patagia same. Abdomen gray, anal tuft cinereous. Legs whitish, fore and middle pairs annulated and streaked with black.

Fore wing: ♂ costal fold narrow, over one-third length of wing, not closely appressed, in several specimens the tuft is expanded fan-like in front of the costa, and fold bent under the costa. Colour whitish-gray, with wave-like shades of cinereous-gray on the outer two-thirds, nearly

paralleling the outer margin of basal area. The latter is large, and is the only distinctly-defined marking on the wing; it consists of black scales heavily overlaying the ground colour, and on costa extends to inner fourth, angulated sharply outward to middle of cell, where it reaches inner third of wing, thence obliquely inward to dorsal margin; it is indented once above and twice below middle. The costal fold is ground colour, with four or five black spots. Costa beyond fold ground colour, with faint streaks of cinereous; towards and at apex and before termen these streaks are more distinct and of an olivaceous cinereous shade. A more or less illy-defined shade of blackish scales begins in the extreme apex and runs obliquely to end of cell; in darkest specimens, usually females, the dark scales forming this shade are roughly grouped in two irregular spots, one involving the apex and nearly to end of cell, the other over end of cell and nearly reaching apex of basal area. Ocellic spot not clearly defined. An irregular vertical bar of lustrous-whitish scales before, and another shorter horizontal bar above the space, a few scales of the same below apex. On the darkest specimens the dorsal margin is dotted with black, in paler specimens these dots are cinereous. Cilia grayish-fuscous, preceded on upper half by a narrow black marginal line, twice interrupted, darker below middle. Hind wing, above and below, smoky-cinereous, darker towards apex, cilia a shade lighter, preceded by a darker, then a paler line.

Under side fore wing smoky-fuscous, grayish-white along costa; cilia grayish-fuscous.

Seventeen specimens, male and female, sixteen from Norman Criddle, Aweme, Manitoba, vii, 24, to viii, 13, and one from L. E. Marmont, Rounthwaite, Manitoba, July. I take great pleasure in giving Mr. Criddle's name to this species, as a slight appreciation of his thorough and systematic work in these minute specimens.

Co-types: Marmont's, Criddle's and Heath's and in my collection.

Hysterosia Merrickana, sp. nov.—Expanse, ♂ 19 to 25 mm., ♀ 22 to 26 mm. Light-brownish-fuscous, outer fourth of fore wing dark brown, an oblique streak of the darker colour arising from dorsum a fifth beyond base, and absorbed in ground colour between middle and upper edge of cell.

Head cinereous, a dot of blackish above eye, beneath base of antennæ. Palpi long, once and a half the length of head, slender, second joint rather closely clothed, above and beneath, tuft longer below, outer joint less than half length of second, exposed; cinereous, dotted with

brown on outside. Antennæ, basal joint large, black, outer joint pectinate in ♂, simple in ♀, fuscous.

Thorax smooth, cinereous, patagia brown. Abdomen and anal tuft cinereous; legs same, thickly dotted and streaked with dark brown.

Fore wing: costa moderately arched, apex rounded, termen straight. Colour in some specimens cinereous-brown to cinereous-gray, in others reticulated all over the surface with fine darker lines. A prominent dark-brown or blackish-brown patch involves the outer fourth, its inner edge begins on costa at three-quarters and proceeds obliquely to anal angle, the division line is slightly concave inwardly. ♂ costal fold less than one-third length of wing, narrow, compressed dark brown. Costa between fold and dark outer patch with seven or eight obscure blackish dots. Sometimes two or three about the middle of costa form a darker shade. From dorsum at inner fourth a streak of brown goes obliquely towards costa, and merges in this middle costal shade; this streak is sharply defined inwardly, but outwardly it is gradually lost in the ground colour; width differs in different specimens, in some it is a narrow band, in others it is distinctly defined for a space equal to a sixth the length of wing. Female specimens are generally several shades darker in all particulars. Ocellic spot not defined, before the ocellic space a quadrate spot of a darker shade than the ground colour, and above it a similar smaller spot. Dorsal margin dotted with black. Two small black dots at end of cell, oblique to each other. The outer dark patch contains three darker dots on costa, and one below costa, a darker reticulation before its inner margin. The basal area is paler than any other portion of the wing. Cilia fuscous.

Hind wing pale fuscous, closely reticulated with darker fuscous, cilia fuscous, preceded by a paler line, hind wing beneath the same, but reticulations more distinct, cilia cinereous.

Fore wing beneath dark smoky-fuscous, costa dotted with cinereous, cilia latter colour.

Eight males, five females. Cartwright, Manitoba, viii, 3, Heath; Cincinnati, Ohio, viii, 30, Miss Braun; Algonquin, Illinois, viii, 4–5, W. A. Nason, M. D.; Mt. Desert, Me., Fernald; New Brighton, Penna., vii, 22, to viii, 31, Frank A. Merrick, whose name I take pleasure in honouring.

Co-types: Collections of Fernald, Braun, Merrick, and Kearfott. This species is of the same general appearance as *H. inopiana*, Haw. The latter, however, lacks the conspicuous terminal patch.

(To be continued.)

ON *RHAGOVELIA OBESA*, UHLER.

BY J. R. DE LA TORRE BUENO, NEW YORK.

Rhagovelia, Mayr,* is well characterized by the long spindle-shaped deeply-cleft intermediate tarsi, a peculiarity noted by most of the authors who have referred to the genus. This genus is found in Asia, Africa and the three Americas, but the larger part of the known species is native to the Western Hemisphere, no less than fifteen (including undescribed forms in my collection) being Central American. All the species are fluviatile, save two, which are marine. The marine forms are found in estuaries or along the coasts, and by some authors are held to form a different genus, known as *Trochopus*.

The one species to be found commonly in the Eastern United States is Uhler's *Rhagovelia obesa*,† which can be found in almost any swift streamlet in little congregations, weaving zigzags where the current is most rapid, swimming against it, or else sheltered in the eddy behind some projecting rock, where, in the latitude of New York, the rare winged form is most likely to be found. My collection contains specimens from the following regions: New York, New Jersey, Washington, D. C., and North Carolina. The various local lists we have mention it as occurring in Tennessee, North and South Carolina, Maryland, Virginia, Pennsylvania, Massachusetts, Ohio, New Jersey, and Ontario, Canada. Prof. Uhler states that it is found in the Atlantic States.

In their generic characterization, Mayr, Stal (under the generic name Baecula)‡ and Uhler note the deeply-cleft intermediate tarsi, but it fell to Champion§ to refer to the tuft of hairs in the cleft in the following terms (which Distant quotes in "Fauna of British India, Rhynchota, Vol. II., p. 171"): "Rhagovelia is well characterized by the 3-jointed tarsi, and the long, deeply-fissured terminal joint of the intermediate tarsi. In this fissure there is a series of long ciliated hairs arising from a common stem, which are probably extended fan-like when the insect moves about on the surface of the water; these hairs are sometimes partly extended in dried specimens, but they are usually hidden within the fissure."

Champion's remarks on the hairs are substantially correct, as can be

*Verh. Zool., bot. Ges. Wien., XV., 445, 1865. Reise der Novara, Hem., 181.

†1871. Proc. Bost. Soc. N. H., XIV., 107.

‡1865. Hemiptera Africana, Vol. III., p. 167.

§1901. Biologia Centrali Americana, Heteroptera, Vol. II., p. 131.

seen from the accompanying figures (3, 4 and 5), but his surmise as to the manner of their employment is ambiguous in form, because under it

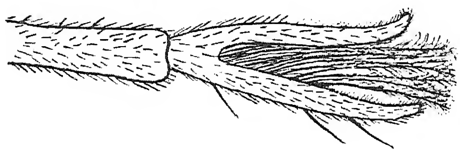


FIG. 3.—Rhagovelia obesa, Uhler. Third joint of intermediate tarsus, showing cleft and swimming hairs. x 10. (Original.)

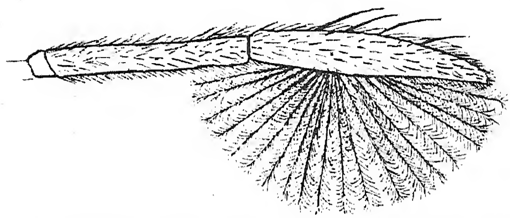


FIG. 4.—Rhagovelia obesa, Uhler. Tarsus of intermediate, showing ciliated swimming hairs spread. Side view. x 10. (Original.)

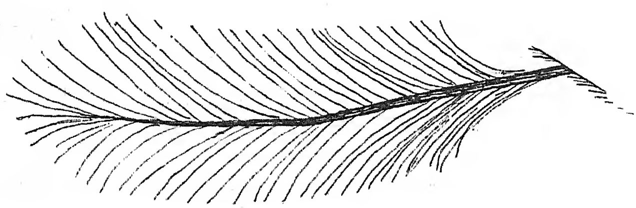


FIG. 5.—Rhagovelia obesa, Uhler. Ciliated hair from intermediate tarsus. x 82. (Original.)

one may conclude that they are spread out *upon the surface* to support the bug, or else that they are employed in propelling the insect when moving about on the surface. At any rate, he merely states an hypothesis in vague terms, based on the appearance of the structures and in the absence of direct observations. The abundance of *Rhagovelia obesa* about New York has made it possible to study the living Hemipteron on a number of individuals I secured for that purpose. I had over twenty living specimens in an aquarium this past summer (1906), under close observation, and the following notes are taken from my field-book, in which I noted the behaviour of the living bugs as I watched them.

The manner of using the tarsal hair tuft, it should be noticed, is very difficult to observe satisfactorily, as the active bug moves its legs very swiftly when swimming. At times, however, either through exhaustion from long-continued rowing, or through weakness in partly drowned individuals, they move the legs more slowly, so it is possible to see the use of the hairs plainly, of which, when swimming fast, it is possible to get only the merest glimpse. The ciliated hairs (figs. 3, 4 and 5), are extended fan-wise (fig. 4), as may sometimes be seen in dried specimens.

The tarsus is in contact with the water along its entire length, with the slit vertical to the surface. When in this position the spread tuft of hairs projects beneath *into* the water, and is a powerful auxiliary in swimming. When swimming under water the hair tuft is also expanded, and is of great assistance. The necessity for an aid in swimming at the surface is explained by the fact that *Rhagovelia* is to be found in the swiftest part of streams, where it may be seen zigzagging against the current in little schools, which in June and July are made up principally of the sexes in copulo. The very young nymphs betake themselves to sheltered and still nooks along the banks.

In cop. the ♂ is above, as is usual with insects. When the ♂ first seizes the ♀ she endeavours to throw him off, and flings herself on her back with the ♂ under her. After a moment's struggle they right themselves. During this the ♂ sets the hind femora at right angles to his body, bending the tibiæ under, and, by means of them, holding the ♀'s second and third pair of legs straight and close to her body. Once he is firmly on her, he releases this hold, but maintains his position by the anterior legs, which clasp the ♀ over the prothorax. He is not connected with the ♀ continuously while on her back. To complete the act, he seizes her as at first, by means of the hind legs. At other times he merely lies on her back quiescent, with his second and third pairs of legs extended, but not touching the surface. As long as the ♂ is on her the ♀ does all the swimming.

It is known that *Rhagovelia* swims freely under water, and to my disgust the individuals I had persisted in diving. They were taken in the afternoon, and being put in an aquarium, when night came, they took to diving. By 11 p.m. they were all actively swimming under water. To penetrate the surface film they put the head down at the surface, and, by means of a few vigorous swimming-strokes with the intermediates, they force themselves under. When under water they swim about freely and rapidly by means of the intermediates, the tarsal swimming-tuft being fully

expanded. In order to come out they swim strongly upwards, and the head breaking through the surface film, the body is forced out by vigorous strokes. When the entire body has emerged it is still held by the surface film, but the dorsum is dry, the velvety pile which clothes the insect shedding the water. Now, by main strength, the legs are lifted free from the prisoning film, and, when this is accomplished, a few strong heaves and jerks liberate the body, and the bug once more glides over the water. Under water *Rhagovelia* appears to be made of silver, owing to the large quantity of air carried down by it enmeshed in its pile.

Rhagovelia is predaceous in common with all the Gerrids, and feeds on such insects as fall into the water, or on its own kind when there is no other food. The winged form is very rare in this latitude, although it is quite common in species from the tropics. The majority of the species of this genus have incrassate hind tarsi in the male, in some cases out of all proportion to the size of the bug.

NEW SPECIES OF NORTH AMERICAN LEPIDOPTERA.

BY WM. BARNES, S. B., N. D., DECATUR, ILLINOIS.

(Continued from page 15.)

Tricholita artega, n. sp.—Expanse, 40 mm.

Fore wing reddish-brown, slightly hoary from a thin admixture of whitish scales. Markings distinct though not contrasting, except white scales on outer side of reniform and the pale orbicular. Basal half line present, dentate, double, pale filled. T. a. almost transverse, scalloped, double, pale filled. Median shade present though not prominent, rather darker brownish-red than rest of wing, as are the other lines. T. p. evenly excerted beyond cell, thence in rather a straight line to inner margin, scalloped between veins, the outer accompanying line barely indicated. The pale filling between the lines is specially indicated on costa and inner margin. Two or three pale points on costa beyond t. p. line. S. t. pale, irregular, rather diffuse, preceded by a slightly darker shading. Veins, especially through terminal and subterminal space, slightly darker. Fringe yellowish-white at base, darkened outwardly. The wing is somewhat lighter along costa and inferior portion of median space, from the increase in number of white cells in these portions. Orbicular a somewhat round yellowish spot, pale contrasting with ground colour. Reniform long, slender, upright, with faint black ring, especially marked on outer side, filled through outer half and lower end with white scales, the remaining portion being of the ordinary ground colour.

Hind wing rather even dark fuscous, with very faint trace of discal bar. Fringe with pale line at base, followed by dusky shade, whitish terminally.

Beneath a well marked mesial band on both wings. Fore wings dusky centrally, yellowish-brown outwardly, along costa and inner margin. Head and collar concolorous with fore wing. Quadrate tuft at base of abdomen, with whitish scales at tip. Abdomen fuscous, terminal segment with long pale yellowish-white hair, separated by sharp line from the fuscous tint of remainder.

Male similar to female except the antennæ, which are broadly pectinated, while simple in the female, and the terminal abdominal tufting, which is here yellowish-brown instead of white.

Type, ♂ and ♀, Santa Catalina Mts., Ariz., August.

Xanthia cordova, n. sp.—Expanse, 25 mm.

Resembles *Alcandra*, Druce Biol. Centr. Amer., Plate 44, fig. 12. Fore wing yellow, with purplish-brown markings. T. a. line somewhat outwardly oblique, dentate. T. p. line scalloped, moderately exserted over cell, then with a gentle inward curve to inner margin. A row of intra-venular patches of purplish-brown scales represent the s. t. line. Broad purplish shade between reniform and t. p. line, another between ordinary spots, the two joining below reniform into a single band, which is cut squarely off before reaching inner margin. Purplish patch in cell to inner side of orbicular. None of these shades quite reach costa. Three or four purplish spots on costa before apex. Fringe concolorous, with slightly darker line at base. Hind wings semi-translucent, pale-yellowish, slightly darker outwardly. Fringe concolorous, with slightly darker line at base. Head and thorax somewhat more brownish than fore wings. Abdomen somewhat paler shade of the same colour.

Beneath, fore wings even pale-yellowish. The ordinary spots and surrounding darker area of upper surface transmitted through wing. Mesial band from costa to middle of wing yellowish-brown, angled below costa, some dark scales along costal edge, and shade of same from apex to angle of mesial band. Fringe concolorous with darker line at base, slightly checkered by some orange hairs between the veins. Hind wing with yellowish-brown mesial band from costa to middle of wing. A slight scattering of brownish scales along costa. Fringe concolorous with darker line at base.

Types Chiricahua Mts., Ariz.

Xanthodes amorata, n. sp.—Expanse, 28 mm.

Fore wings pale straw colour, with yellowish-brown markings. Blackish spot on costa, about two millimetres from base. Wing between that and base brownish. Wing crossed by three narrow brown lines, the first slightly before middle of wing, outwardly oblique to cell, transverse across cell, thence inwardly oblique to inner margin; the second strongly outwardly oblique from costa to beyond cell, thence making an acute angle inwardly oblique, with slight inward curve to inner margin. This line in upper portion somewhat heavier than the others. Third line parallel to second, and about midway between it and outer margin. From end of cell to outer margin there are two parallel brown dashes about a millimetre apart, the upper one passing through apex of angle of outer line. Submarginal row of small black dots. The wing, especially in the mesial portion, is thinly dusted with brownish scales; these are somewhat more thickly grouped between the parallel dashes. Fringe brownish, with a darker line at base. Hind wing pale yellowish-white, fringe concolorous. Head, collar and thorax slightly darker than ground colour. Abdomen ground colour, slightly ringed with brownish.

Beneath, fore wing yellowish-white, somewhat more yellow along costa and at apex. Fringe brownish-black. The second line above quite well marked below, and traces of the third can be made out. Hind wing pale yellowish-white, slightly more yellow along costal half. Mesal band partially crossing wing from costa.

Fore legs with tarsi heavily coated with long yellowish-brown hair.

Type, ♂ and ♀, Babaquivera Mts., Ariz., August.

Lythrodes arivaca, n. sp.—♀. Expanse, 32 mm.

Fore wings creamy-white, with faint yellowish tinge. Ordinary spots, a double band across middle of wing, and veins ochraceous-brown. Orbicular and reniform close together at end of cell, the former pale, centered with well-marked ring; the reniform, which almost touches it, is lunate, with well-marked outer ring and dark centre. The inner of the two bands crossing wing is somewhat heavier than the outer. Beginning with rather a diffuse patch on costa, it passes, with a gentle curve, between the ordinary spots, then with a rather sharp angle downward and outward to inner margin. The outer line is separated from the first about a millimetre, and is parallel to it below the ordinary spots; in the upper portion of the wing it diverges somewhat, passing around the reniform; the space between the lines is filled with a paler shade of the same colour. There is a faint flush of the same shade beyond the reniform, and to a

lesser extent beyond the median band in the lower half of the wing. A faint ochraceous curved band leaves costa, above orbicular, passing downward and inward to base, almost at inner margin, dividing this portion of wing in about two equal parts, the lower half being somewhat more tinged with ochraceous than the upper. Fringe white, with ochraceous blotches between veins. Hind wings yellowish-white, more or less tinged with fuscous, especially outwardly. Fringe white.

Beneath, fore wing blackish centrally, paler along costa and outer margin. Hind wings pale yellowish-white.

Collar, patagia and thorax creamy-white, with ochraceous shading. Thorax with posterior tuftings. Abdomen fuscous-yellow.

Type, one ♀, Southern New Mexico, from Mr. Poling.

Chamaclea gladiola, n. sp.—Expanse, 28 mm.

Fore wing, at base, beyond s. t. line and a large oval patch in the centre below costa, creamy-white. Remainder of wing dark olivaceous-brown, with an admixture of violet and paler olivaceous and yellow scales. Ordinary lines not distinctly marked. Basal portion of wing is creamy-white except along costa, where it is of the same shade as the median portion of wing. The reniform is present at outer edge of oval white patch, though not very plainly marked. It is pale-ringed, with dark centre, narrow and upright. Indications of a row of terminal black intravenular dots. Fringe white. Hind wings blackish-brown, with faint indications of mesial band and discal dot. Fringe white.

Beneath, fore wings blackish, with central yellowish patch, yellowish along costa. Hind wings yellowish-white, with dusky mesial band. Collar yellowish at base, remainder of collar, patagia and thorax white. Thorax posteriorly with some olivaceons and violet scales.

Types, ♂ and ♀, Santa Catalina Mts., Ariz.

This species should stand next to *Anthœcia scira*, Druce, Biol. Centr. Amer. Het., Pl. 28, fig. 5. The type of maculation and colours are about the same, but the Mexican species entirely lacks the large white patch in centre of wing.

Oxycnemis acuna, n. sp.—Expanse, 15 mm.

Ground colour gray, more or less covered with brownish scales, markings black. Ornamentation similar to other species of the genus. Claviform long linear, gray, narrowly outlined in black, brownish centered. Orbicular similar in form and size to claviform, gray, narrowly outlined in black, brown centered, lying parallel to and extending a little beyond claviform. Reniform gray, with brown centre, surrounded by a few black

scales, especially on outer and inner sides. A whitish shade extends from reniform superiorly to just before apex. S. t. line pale, irregular, broken, preceded by blackish markings, more pronounced at apex and towards inner angle, the remainder being broken into wedge-shaped markings. A neat, well-marked even terminal black line. Fringe concolorous, obscurely checkered, with paler basal and mesial line. Hind wings soiled whitish, with faint discal dot. Fringe a trifle paler, with well-marked line at base. Head and thorax concolorous with fore wing. Abdomen yellowish-fuscous.

Beneath, fore wing pale fuscous, somewhat paler along costa. Hind wing whitish, somewhat yellow along costa. Yellowish-brown terminal line at base of fringe.

Types San Antonia, Texas.

Grotella calora, n. sp.—Expanse, 17 mm.

Fore wing white. Black spot on costa at base, one at inner fourth, one on inner margin opposite to it, one in centre of wing between and a trifle inside of these, one on costa in middle of wing. An outer row of four spots: one on costa at outer fourth, one at end of cell, one on inner margin, with another somewhat above and to outer side of it. Fringe white. Hind wing uniform dark fuscous, fringe white.

(To be Continued.)

SOUTHERN BUTTERFLIES IN MASSACHUSETTS.

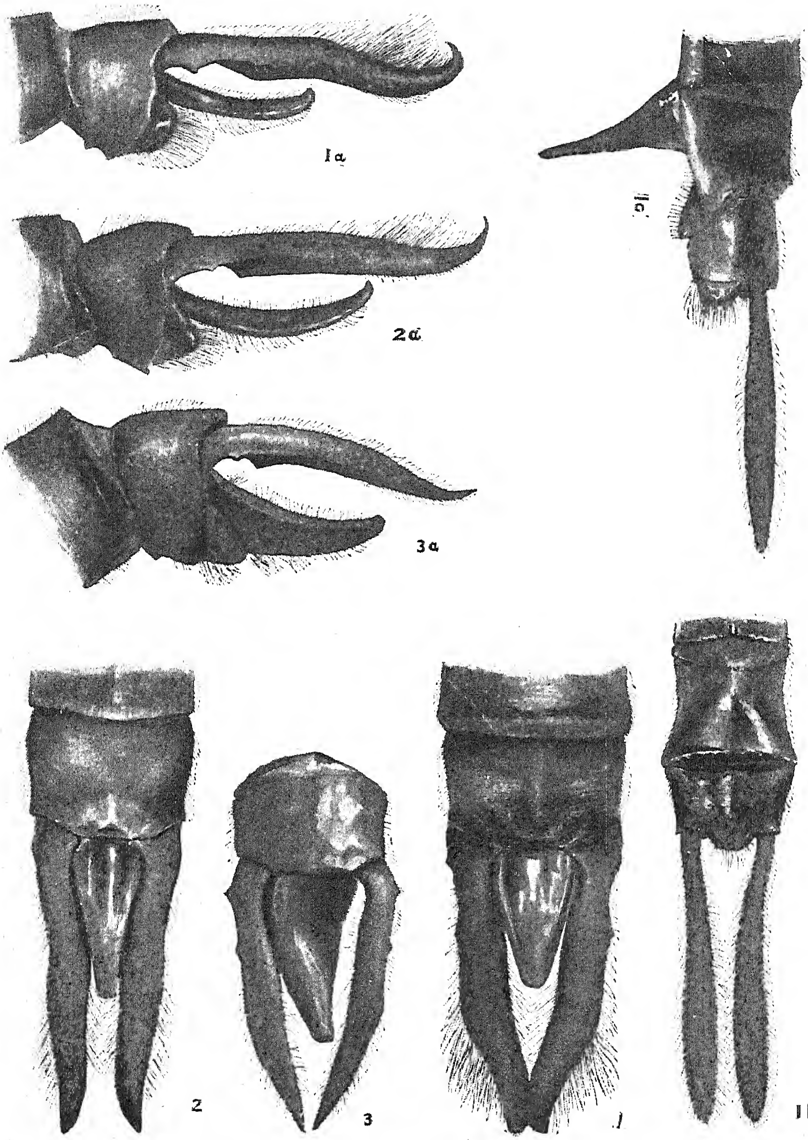
I should like to know whether any New England readers have noted the presence of *Laertias philenor* and *Achlarus lycidas* north of their usual haunts during the past season.

Both of these butterflies were extremely common this year at Melrose, Mass. (seven miles north of Boston). *Laertias philenor* larvæ were everywhere noticeable on *Aristolochia sipho:* the first brood in June and a second in August and September. The butterfly itself was frequent in the gardens throughout the summer.

Achlarus lycidas was easily captured during the early part of July in certain localities where its food-plant (Desmodium) was abundant. The females were readily detected laying their eggs singly upon the Trefoil or busily engaged feeding upon the wayside clover.

I am interested to know whether these species are generally moving northward into New England, or is Melrose one of a very few favoured spots? Roland W. Harris, Boston, Mass.

Mailed February 14th, 1907.



SOMATOCHLORA WILLIAMSONI (NEW SPECIES).

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A NEW SOMATOCHLORA, WITH A NOTE ON THE SPECIES KNOWN FROM ONTARIO.

BY E. M. WALKER, B. A., M. B., TORONTO.

In my "First List of Ontario Odonata" (CAN. ENT., XXXVIII, 1906, p. 151), I recorded *Somatochlora elongata* (Scudd.) from Toronto, De Grassi Point (Lake Simcoe) and Algonquin Park, and remarked upon the fact that the superior appendages of the male were more incurved in the examples from Toronto and Lake Simcoe than in those from Algonquin Park. A further study of these specimens revealed other marks of distinction, and led me to the conclusion that the two forms were specifically distinct, those from Algonquin Park belonging to true *elongata*, while the others represented a closely allied but apparently undescribed species. Mr. E. B. Williamson, to whom I sent sketches of the abdominal appendages of both forms, wrote that he had also taken them both, and was likewise of the opinion that the species in question was new. Dr. Calvert, to whom I sent a specimen, expressed the same opinion, and added that he had a pair of the same form from Sherbrooke, Que., taken by L'Abbé Begin. Since then I have examined these specimens myself.

I also learned through Mr. Williamson that the description of the nymph of *elongata*, as given by Prof. Needham (Aquatic Insects in the Adirondacks, Bull. 47, N. Y. State Mus., 1901, 499), probably belongs to the same new species. I have one of Needham's specimens from the same locality before me, and it is certainly identical with my other specimens. Needham's figures of the appendages are from specimens in the Museum of Comparative Zoology, Cambridge, Mass., and are those of true *elongata*.

Somatochlora Williamsoni, sp. nov.

1901. *Somatochlora elongata*, Needham, Aq. Ins. in the Ad., Bull. 47, N. Y. State Mus., 499.

1906. *Somatochlora elongata*, Walker, CAN. ENT, XXXVIII, 151.

Closely related to *S. elongata* (Scudd.), with which it agrees in size and proportions, but differs in the form of the superior abdominal appendages of the ♂ and in certain details of colour pattern.

Vertex very dark metallic green, evenly punctate. Frons above and in front dark metallic greenish-blue, bordered below and at the sides by a brownish-yellow band. The dark area, except a narrow median smooth space at the bottom of the depression above, is rather coarsely and irregularly pitted and covered by dark brown pile, while in the lighter yellowish parts the pits are much finer and the pile, as elsewhere in the face, paler. Anteclypeus and labrum pale yellow; postclypeus reddish- or yellowish-brown, generally much darker in its middle part, but not forming as distinct a dark band between the lighter parts above and below it as it does in *elongata*, in which the middle portion and sometimes the entire postclypeus forms a strong dark brown or black band between the paler parts of the frons and anteclypeus. Labrum black. Occiput shining reddish-brown, well rounded behind, bearing dense dark brown hairs above, pale brownish ones behind. Posterior surface of head shining black, with a submarginal dense row of long pale brownish hairs in line with those of the occiput.

Prothorax black, anterior lobe broadly margined with very pale yellow, posterior lobe dull metallic bronze-green, with pale brownish hairs, convex behind. Meso- and metathorax dull metallic green, with blue or violet-blue reflections, especially upon the epimera, covered with long pale yellowish-brown hairs, except upon the antealar sinus, where the hairs are dark brown, very short and denser than elsewhere. A few black hairs also about the bases of both pairs of wings. A dull yellow mesepimeral band usually 4–6 times as long as broad, and an elongate-oval metepimeral spot of the same colour. These markings may be very inconspicuous in old examples. Under parts of thorax pale yellowish brown. Legs black with the following parts yellowish-brown: the coxæ, or greater part of them, first and upper surface of second trochanters, first femora, except near the knees and sometimes the under surface, upper surface of second femora except distally.

Abdomen slightly more than 2½ times as long as head and thorax, tumid at base, narrowest before middle of 3, thence expanding to apex of 5, where width about equals base of 2, sides of 6 parallel, remaining segments very gradually narrowing. Colour dull dark bronzy-green, covered with fine short pale brownish hairs; sides of 2 and base of 3 shining dark brown with conspicuous pale brownish hairs, genital lobe black. A brownish yellow band on lateral surface of 2 in its lower half, passing just above genital lobe, where it is generally constricted and often

divided into two spots and continued posteriorly as a ventro-lateral triangular spot on base of 3. Dorsum of 2 with a yellowish spot on each side distally, followed on dorsum of 3 by a smaller and sometimes obsolete basal spot which is often connected below with the ventro-lateral spot of the same segment.

Superior appendages black, about as long as 9 + 10, separated at their origin by a space about equal in width to base of one of the appendages; the latter broadest at base, becoming narrower and somewhat incurved in proximal fourth, where both margins as seen from above are gently concave; middle third gradually approaching middle line, somewhat tumid and rounded, with sides parallel; distal third very slightly tapering, bent inwards, forming an angle of about 40° with its fellow of the opposite side. Viewed from the side they appear distinctly but not strongly arched, with the apices strongly upturned and ending in a recurved point. The outer margin is bent downwards and bears a large but obtuse basal tooth, usually followed before the middle by another very inconspicuous one, after which it fades into the rounded lateral surface. Both teeth are usually visible from above. Ventral surface concave at base, beyond rounded and somewhat tumid. A slight ridge passes from the concavity obliquely backwards and inwards, forming a prominence which appears as a very obtuse and rounded angle when viewed from the side, thence continued as the slightly angular inner margin. The hairs on distal half above are long and dense, being much longer than depth of appendage.

Inferior appendage about half as long as superiors, triangular, about ⅔ as broad at base as long, sides slightly convex, apex rounded, lateral surfaces sulcate; in profile view it forms a shallow curve with the concavity upwards, the upper and lower margins nearly parallel, apex surmounted by a short recurved tooth.

♀ differs from ♂ in markings as follows: The ventro-lateral spot on 2 is unbroken, well-defined above, but fades below into the dull yellowish brown which covers most of the ventral surface of 2 and 3. Dorsum of 3 is broadly margined with brownish yellow, most conspicuous on proximal half, and continued as a less distinct elongate spot on basal third of 4. Indistinct spots of same colour occupy antero-lateral angles of 5, 6, 7 and 8. Abdomen broadest at middle of 2, where it is about twice as broad as at base of 9, tapering equally to middle of 9, whose sides diverge in distal half so that breadth at apex is about ¼ greater

than at base. Apex of 10 nearly equal to base of 9. Ventro-lateral margins of 8, 9 and 10 and ventral surfaces of 9 and 10 yellowish, vulvar lamina rather longer than depth of 8 at apex, spout-shaped, elongate triangular in profile, with ventral surface slightly concave, apex rounded.

Appendages ½ longer than 9 + 10, black, evenly covered with short hairs, slender, subcylindrical, slightly bent inwards in proximal half, enlarging distally its proximal two-thirds, thence narrowing again very slightly, apex rounded. A slight carina runs along outer ventro-lateral margin in its proximal half.

Wings (♂ ♀) hyaline, yellow at base in ♀, becoming somewhat suffused with brownish in old examples, venation black, pterostigma dark brown.

Front-wings: Antecubitals 7–8, postcubitals 5–9, usually 7; triangles 2-celled, internal triangles 3-celled, one submedian cross-vein on a level with the first antecubital; 3 post-triangular cells, followed by 2 rows of cells to near the level of separation of the median and principal sectors, then 3 rows; generally 4–5 cells at the margin; membranula sooty-gray.

Hind-wings: Antecubitals commonly 5, sometimes 6, postcubitals 6–10, generally 7–9; triangles 2-celled, internal triangles free, one other submedian cross-vein before the level of the first antecubital; 3 post-triangular cells (1 ♀ has 2 on one side, 4 on the other) followed by 2 very short rows of cells, then 3 rows which divide and subdivide until at the margin there are 9–12 cells; anal triangle of ♂ 2-celled; membranula sooty-gray, paler towards base, the pale area usually confined to a small spot at the immediate base, but sometimes diffused over the basal half.

Dimensions: Abdomen (incl. apps.) ♂ 41–45, ♀ 45.5–46; sup. apps. ♂ 4, apps. ♀ 4.5–5.25; hind-wing ♂ 37–40, ♀ 39–40; pterostigma 2.6–3; hind femur ♂ 8.5–9, ♀ 8–8.5 mm.

This species is most nearly related to *S. elongata* (Scudd.), from which it differs chiefly in the superior appendages of the male. In *elongata* these appear, when viewed from above, slenderer, straighter and more regular in outline. The proximal half is slightly bent inwards, but in the distal half they are parallel, with the apices well separated. The basal tooth is much smaller than in *Williamsoni*, and invisible from above, while there is no second tooth before the middle. On the other hand the carina on the under surface is much better developed, beginning as a prominent tooth, where in *Williamsoni* only a rounded eminence occurs. In profile

the appendage is less arched and the apices not so strongly recurved. The hairs on the upper surface are shorter and not so dense. The inferior appendage is a little more than half as long as the superiors. *Elongata* also differs in the much brighter and better defined yellow markings on the sides of the thorax and second abdominal segment, which, however, have much the same form and distribution. The brown of the legs is reduced to the coxæ and a streak along the proximal half or more of the upper surface of the first femora.

The dorsal view of the ♂ appendages is in some respects more like that of *S. minor*, Calv., but the superiors in the latter are relatively shorter, more slender, and are more widely separated at base, the apices are not so much upcurved and the hairs are much shorter and more thinly and evenly distributed. The basal tooth is smaller and the inferior carina bears a prominent tooth as in *elongata*.

Of European species *Williamsoni* comes nearest to *S. flavomaculata* (Lind.), but differs from it quite obviously in both appendages and colour-pattern.

Described from 10 ♂♂, 3 ♀♀. Toronto, June, 1901, 1 ♂ in house; De Grassi Point, Lake Simcoe, Ont., June 29–Aug. 1, 5 ♂♂, 3 ♀♀; Temagami, Ont., Aug. 15, 1906, 1 ♂ (P. Hahn.); Oden, Mich., Aug. 11, 1906, 2 ♂♂ (E. B. Williamson); Bone Pond, Saranac Inn, N. Y., July 26, 1900, 1 ♂ (J. G. Needham).

The known range of this species, including the Sherbrooke record, is thus from Quebec and north-eastern New York to northern Ontario and Michigan. It belongs, apparently, to the Canadian and Transition Zones, being evidently rare at Toronto, which lies towards the southern boundary of the Transition Zone, but much more numerous northward.

I take pleasure in naming this insect after Mr. E. B. Williamson, who has shown me many favours of late and given me a great deal of valuable advice and assistance in my studies of dragon-fly life.

He writes me that his specimens were taken about 4 p. m. on Aug. 11, 1906, "at the mouth of the Minnehaha, a small stream flowing into Crooked Lake, Oden, Michigan. The Minnehaha, as it approaches Crooked Lake, pursues a circuitous course through a large prairie-like and marshy tract. The *Somatochloras* were observed feeding along the shore line among the rank cattail or Sparganium growth just at the water's edge. They were leisurely in their movements, spending much time at a place,

before rising slightly and moving to another location. Earlier in the day a *Somatochlora* (?) of similar size was seen over a clearing near the lake, flying at an average height of possibly 20 feet."

At De Grassi Point, Lake Simcoe, they are quite numerous during the latter part of June and July, and are occasionally met with in August. Here they frequent woodland roads and glades, where I have most often seen them late in the afternoon, hovering in the sunshine in the manner described by Mr. Williamson, sometimes in considerable numbers. They seldom descend within reach of the net, however, flying usually at a height of 20–30 ft., the height increasing as evening advances and the shadows creep up the trees. They disappear at sundown. I have also occasionally seen them flying comparatively low over an open marsh at the mouth of a broad, sluggish, weed-grown creek, in which the nymphs probably breed, as it is the only suitable-looking place in the vicinity.

Since my list was published I have added another species of *Somatochlora, S. Walshii* (Scudd.), to the Ontario fauna, and Mr. Williamson has taken a number of specimens of *S. elongata* (Scudd.) at Hayden's, Algoma. So that the Ontario records for this genus now stand as follows:—

S. elongata (Scudd.) Algonquin Park, Hayden's, July 31, 1906.

S. Williamsoni, n. sp. Toronto, L. Simcoe, Temagami.

S. Walshii (Scudd.) De Grassi Point, Lake Simcoe, Aug. 7, 1906.; 1 ♂ flying leisurely over field near edge of wood.

S. forcipata (Scudd.) Algonquin Park.

S. tenebrosa (Say.) Hamilton (?)

Several other species will be sure to appear in the north.

Explanation of Plate 2.

Fig. 1. *Somatochlora Williamsoni*, n. sp.—Lake Simcoe, Ont., dorsal view of ♂ abdominal appendages; 1a, lateral view of same; 1b, dorsal view of ♀ appendages; 1c, lateral view of same.

Fig. 2. *S. elongata* (Scudd.)—Algonquin Park, Ont., dorsal view ♂ appendages; 2a, same, lateral view.

Fig. 3. *S. minor*, Calv.—Type specimen, Franconia, N. H., dorsal view ♂ appendages; 3a, same, lateral view.

NEW GENERA AND SPECIES OF DIPTERA.

BY D. W. COQUILLETT, WASHINGTON, D. C.

CONDIDEA, new genus of Syrphidæ.

Near *Helophilus*, but the antennal arista is plumose, the eyes contiguous in the male, etc. General aspect of a species of *Didea*. Head in profile very similar to that of *Sericomyia militaris* (Williston's Synopsis N. Am. Syrphidæ, Plate VII, fig. 36), except that the face is somewhat shorter; antennæ as in that figure except that the third joint is subquadrate, with rounded angles; body almost bare, abdomen noticeably wider than the thorax, subovate, greatly depressed; legs unarmed, femora not thickened; venation of wings as in *Helophilus conostomus* (Williston, l. c., Plate VIII, fig. 3a), Type, *Condidea lata*, new species.

This interesting form is practically a *Sericomyia* with a pediform first posterior cell; it thus forms a connecting link between the tribes Sericomyini and Eristalini.

Condidea lata, new species.—Black, the thorax tinged with bronze, the face and cheeks except a stripe extending from each eye to the oral margin, the lower edge of the front and of the occiput, a pair of spots on abdominal segments two, three and four, also the venter except apically, light yellow, apex of abdomen reddish; wings hyaline, stigma yellowish brown. The yellow spots on the abdomen do not touch the lateral margin; the first pair is very large and nearly circular; second pair less than half as large, the outer posterior angle of each spot almost cut off by the black ground colour; the third pair is much the smallest, each spot reniform and placed obliquely. Length, 15 mm.

North Saugus, Mass. A male specimen collected by Mr. F. H. Mosher. Type No. 10156, U. S. National Museum.

ACHÆTOMUS, new genus of Helomyzidæ.

Near *Helomyza*, as restricted by Loew, but with only two pairs of dorsocentral bristles, propleural present, two pairs of fronto-orbitals, etc. Eyes circular, cheeks nearly as wide as the eye-height, third joint of antennæ broader than long, arista dorsal, bare. Femora without bristles, tibiæ with apical and pre-apical bristles only. Venation as in *Helomyza*, spines of costa well-developed. Type: The following species:

Achætomus pilosus, new species.—Reddish brown, the scutellum and legs yellow, bases of abdominal segments three to five dark brown, hairs and bristles black. Hairs of cheeks covering their lower half, no bristles near vibrissæ. Pleura almost wholly covered with hairs except the portion

posterior to the sternopleura, one sternopleural bristle, no other pleural bristles present; scutellum without hairs, four scutellar bristles. Wings hyaline, unmarked except the extreme base and the stigma, which are yellowish. Length, 8 mm.

North Saugus, Mass. A male specimen collected by Mr. H. M. Russell. Type No. 10157, U. S. National Museum.

OMOMYIA, new genus of Phycodromidæ.

Near *Coelopa*, but very hairy and having the scutellum greatly elongated, etc. Eyes ovate, longer than high, cheeks about as wide as the eye-height, no vibrissæ, face straight, with a high median carina which is prolonged upward between the bases of the antennæ: antennæ nearly as long as the face, the first joint minute, the second as wide as long, the third ellipsoidal, nearly twice as long as wide, arista bare, thickened on the basal fourth, the first joint as long as wide, the second nearly twice as long, arista inserted near the base of the dorsal edge of the third antennal joint; front sparsely covered with long hairs, from which the usual bristles, except the ocellars, are not distinctly differentiated; occiput strongly convex. Thorax bearing one pair of dorsocentral bristles, two supra-alar, one notopleural, one mesopleural, one propleural, and one sternopleural bristle. Scutellum bare, nearly one-half as long as the mesonotum, its sides emarginate, its apex subtruncated, two pairs of long lateral bristles. Abdomen narrower than the thorax, elongate ovate, somewhat depressed. Legs rather short and robust, without bristles, except on the middle tibiæ, which are fringed along the outer side besides bearing several at the apex, a stout bristle at apex of inner side of each hind tibia, under side of tarsi beset with short spines, first tarsal joint longer than any of the following joints. Venation complete, auxiliary vein present, contiguous with the first, except toward its apex, costa beset with short spines, sixth vein prolonged to the wing-margin, last section of the fourth vein parallel with the third, first vein distinctly dilated before its apex. Type, the following species:

Omomyia hirsuta, new species—Yellow, a tridentate spot on upper half of occiput, prolonged to include the ocelli, the thorax, except the lateral margins and several spots on the pleura, the base of scutellum and a crossband on each segment of the abdomen, black; hind femora sometimes partly brown; thorax opaque, gray pruinose, abdomen polished; hairs mixed, black and yellow; wings hyaline, a circular brown cloud just before apex of second vein. Length, 5 mm.

Lancaster, California. Eight specimens collected in April, by Mr. A. Koebele. Type No. 10158, U. S. National Museum.

NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

(Continued from page 60.)

Evetria Siskiyouana, sp. nov.

Head pale ochreous, a dash of dark brown behind antenna and a darker shade above eye; palpi pale ochreous within, dark brown outside, changing to black at apex; antenna smoky-black, whitish between joints, basal joint ochreous-brown; abdomen brownish-fuscous; legs ochreous-white, heavily shaded and banded with blackish-brown.

Fore wing evenly spotted with grayish-ochreous; the margins of the spots are usually shining, and are frequently overlaid with ochreous and ochreous-brown. They are separated by irregular horizontal and vertical black lines. There are four to five irregular vertical rows of spots; where each touches the costa they usually do so as a geminate spot, enclosing a dot of dark brown. Terminal line dark brown, preciliate line black, inwardly edged with whitish, cilia leaden-gray, cut by two dashes of whitish beneath apex.

Hind wing smoky-brown, cilia dark gray; under side dark brown, clouded with whitish, with dark brown spots on costa before apex and terminal line of same colour below apex. Under side fore wing smoky-brown, with dark brown costal spots, separated by cream-white. The description is of the Siskiyou specimen; the one from Oregon is darker, head and palpi dark gray and brown, the spots on fore wing are more overlaid with brown, especially on upper half; but I do not believe they are other than local races of the same species.

Expanse, 21–22 mm.

Two ♂ specimens: Siskiyou Co., California; Oregon, Koebele; both from U. S. Natl. Mus. collections.

Co-type U. S. Natl. Mus.

The larvæ of this species are probably borers in the twigs or cones of *Conifera.*

Eucosma Denverana, sp. nov.

Head and palpi cream-white, the latter a shade darker outwardly and below; antenna cream-white; thorax light brown, finely speckled with white; abdomen and legs creamy-white, latter dusted with dark brown.

Fore wing light brassy-brown, speckled evenly all over with white scales, a darker shade on costa at base, and a faintly darker shade on

inner fourth of dorsum. Cilia very pale fuscous-brown, heavily dotted with whitish scales, with an indistinct darker line at base.

Hind wing light smoky-brown, long hairs at base yellowish, cilia whitish, with a darker basal shade; under side the same, but whiter below middle of wing. Under side fore wing brassy-gray, white below fold, cilia white.

Expanse, 24–28 mm.

Five specimens, all Denver, Colo., four from Dr. Barnes's collection, received from U. S. Natl. Mus., and collected by E. J. Oslar; one collected by Dyar and Caudell.

Eucosma tomonana, sp. nov.

Head, palpi, antenna and thorax hoary-gray; abdomen and legs light cinereous-gray, latter dusted with coppery-brown.

Fore wing hoary-gray, with two blackish-brown dorsal spots. Even under a lens the ground colour is almost uniform, with but very faint strigulations. The costa is streaked with long lines of grayish-brown; one from just beyond middle goes to anal angle, beyond this is a short dash, then a longer line that curves outwardly and ends in middle of termen, enclosing the rounded ocellic area; between the latter line and apex are two shorter lines that join beneath costa, and continue as a single line to termen beneath apex. The gray ground separating these faint brown lines is slightly shining, and on the costa, in each of the gray interspaces, is a narrow darker dash. Below the middle the ocellic area is shining gray, in which are a few horizontal black dashes. The dorsal spots are very conspicuous on the light ground colour; the inner is a flattened triangle with narrow base, on inner third of dorsum; it curves obliquely outward, the upper end, as a fine line, reaching middle of wing; the outer spot is ovate, with its broadest and flat side between outer third of dorsum and anal angle; it does not extend beyond lower fourth. Cilia speckled gray.

Hind wing light smoky-gray, paler beneath costa, cilia whitish-gray; under side the same, faintly reticulated at outer end. Under side fore wing smoky-fuscous, whitish beneath fold.

Expanse, 12–15 mm.

Eight specimens, Montclair and Essex Co., Park, N. J., Light Trap, Aug. 21 to Sept. 11; one specimen, Westmount, Quebec, Canada.

Eucosma gomonana, sp. nov.

Head and palpi whitish-gray, latter a shade darker outside; thorax whitish-gray, mottled with darker gray, ends of patagia white; antenna

whitish-gray; abdomen light cinereous, upper side of middle segment gray, anal tuft yellowish; legs whitish, dusted with dark brown.

Fore wing fuscous-brown, crossed by shining gray fasciæ. The dark basal area on dorsum extends to inner third, goes slightly outward to middle, then inward to inner fourth of costa; it is somewhat mottled with lighter scales, which form an abbreviated fascia on the dorsal half. Beyond is a broad shining gray fascia, divided vertically by a fine line of brown, and on upper half of wing each side is subdivided by a brown line from costa; its outer edge is slightly convex between costa and fold, widening below fold to dorsum, which it reaches just before anal angle. Beyond is a narrow fascia of brown, beginning as a line from costa and ending at anal angle, where it is half the width of the preceding gray fascia, and of about equal width to a gray fascia which follows it; the latter begins as a geminate spot on outer third of costa, it is slightly constricted at upper third; the ground colour on either side of its lower half contains a few black scales. Following is a broad brown spot on costa, diminishing to a line below middle and ending in lower third of termen. Before the apex is a broad gray costal spot, which curves into termen below apex, on its lower edge it connects with a gray spot in the ocellic area. The apical spot is brown, and a streak of the same colour runs before termen to anal angle. Cilia dark gray, with a darker basal line, which is followed by a thin whitish line.

Hind wing light grayish-brown, cilia whitish, with a darker line near base; under side the same. Under side fore wing smoky-black, gray below fold.

Expanse, 8–11 mm.

Twenty specimens: Essex Co. Park and Watchung Mountains, Essex and Passaic Counties, New Jersey, April 20 to May 15.

Eucosma domonana, sp. nov.

Head, palpi, thorax and antenna light cinereous-gray; abdomen beneath and anal tuft same colour, above leaden-gray; legs ringed and dusted with bronzy-brown.

Fore wing bronzy-brown, finely speckled with whitish-yellow; the few spots and fascia are of the ground colour, with the whitish scales absent. There is a dark spot between fold and dorsum before middle; a narrow dark fascia from middle of costa to anal angle, three dark costal spots between the fascia and a dark spot in apex; between each two of the costal spots is a yellowish-white geminate dash. The terminal line is

black, bordered by a broader brown streak below the middle; the terminal line is cut by two white dashes below apex; there are two similar whitish dashes, one above and one below the anal angle, but they do not cut through the terminal line. Between the inner dark spot and the fascia, in the lower half of wing, the whitish specks are somewhat thickened, making a paler middle dorsal patch. Cilia dark gray, paler at base.

Hind wing smoky-brown, cilia same, with a paler line at base; under side both wings the same, with whitish costal dashes repeated on upper wing.

Expanse, 11–12 mm.

Two specimens, Framingham, Mass., June 10, C. A. Frost.

Eucosma zomonana, sp. nov.

Head and palpi cinereous-brown; antenna grayish-white; thorax cinereous-brown, whitish on posterior end and patagia; abdomen grayish-brown, anal tuft yellowish; legs gray, thickly dusted and banded with brown.

Fore wing shining gray, with an outwardly oblique dark brown fascia from inner third of dorsum to middle of wing, a long, outwardly convex brown fascia from between inner third and middle of costa to anal angle; the lower half is much darker than the upper; a brown shade from end of cell into apex, flatly triangular, the points being at end of cell and apex and the flattened base uppermost; the inner end sometimes connects with the dark spot of the dark fascia; this shade and the dark spot define inwardly and above a shining whitish-gray ocellic spot, in the middle of which are two or three horizontal dark brown lines. From outer third of costa are several shining whitish-gray oblique streaks; in the lightest specimens the streak before the apex cuts through the dark shade. The termen is bordered by a whitish-gray fascia. Cilia paler, shining gray.

Hind wing smoky-gray, cilia lighter, preceded by a darker basal line; under side the same; under side fore wing darker.

Expanse, 11–15 mm.

Five specimens: New Brighton, Beaver Co., Penna., May 22 to June 6, and Aug. 23 to Sept. 14, F. A. Merrick. One of these specimens was identified at the U. S. National Museum, for Mr. Merrick, as *E. abbreviatana*, Wlsm., and one as *E. solicitana*, Walk., but they do not resemble either of these species.

Epinotia Watchungana, sp. nov.

Head blackish-brown on sides and face, whitish-gray on top; palpi whitish-gray, streaked with blackish-brown outside above, and speckled with same colour below; apical joint black outside, with a grayish bloom within; antenna brownish-gray; thorax mottled whitish-gray and blackish-brown; the base of patagia is dark and a dark spot before the whitish end of posterior tuft, a fine dark median line; thorax light brown, with overlapping rings of whitish scales; legs whitish, banded and dusted with bronzy-black.

Fore wing mottled light fuscous gray and black, the latter partly of a brownish tinge. The most conspicuous mark is the ocellus, which is large, rounded, and occupies the lower two-thirds of the outer fourth; it is grayish-white, vertical side bars shining, and is crossed by four or five horizontal short black lines. Below the apex on costa is a V-shaped whitish mark that connects with a geminate whitish dash in termen and cilia below apex, below costa this mark is shining; it encloses a rounded pale brown, overlaid with fine black lines, apical spot. The costa from base to apex is marked with black and whitish spots and dashes, usually geminate; from a larger one beyond the middle a black line runs beneath the outer costal spots, turning down below apex and merging in a pale brown streak, overlaid with fine black lines, that lies between upper edge of ocellus and termen. On the middle of dorsum there is an oblique whitish patch reaching above fold, but not to middle; it is streaked with darker lines. Before this is a strong black shade, which on inner side obscurely connects with a circle of black scales on lower half of wing close to base. The extreme dorsal edge is gray, dotted with black. A brownish streak runs from outer third of costa to anal angle. Cilia at apex whitish, below the geminate dashes gray finely speckled with black.

Hind wing whitish except around apex and termen, dark gray, cilia white, with a darker line near base; under side whitish, with a few dark specks along costa. Under side fore wing smoky-brown, with costal spots and ciliate dashes repeated.

Expanse, 12–16 mm.

Thirty-five specimens, nearly all from Watchung Hills, Essex Co., N. J., April 21 to May 8; Gloucester Co., N. J., April 30, F. Haimbach; Grimsby, Ont., J. Pettit; New Brighton, Pa., Mar. 22–April 18, F. A. Merrick; Cincinnati, Ohio, April 22, Miss Braun.

Co-type in U. S. Natl. Mus.

Tortrix Baboquavariana, sp. nov.

Head, palpi, antenna and thorax shades of ochreous-brown and yellowish-ochreous; abdomen grayish-fuscous above, pale ochreous on side and anal tuft; legs pale ochreous.

Fore wing light yellowish ochreous, somewhat shining and with a slight pinkish tinge; marked with well-defined ochreous-brown spots and narrow fasciæ; these are usually edged with darker brown, and occur as follows: A crescentiform fascia from lower half of base to above middle of wing, extending outward to inner fourth. A narrow diminishing fascia from middle of costa obliquely outward towards lower side of termen, but at lower quarter turning downward and reaching dorsum before anal angle. On the middle of dorsum is a large rounded spot, reaching nearly to middle of wing; in some specimens a spur from its upper end connects with the angle of the fascia. From costa before apex a fascia, slightly curving inward, ends at lower third of termen. The inner fourth of costa is shaded with dark brown, and a spot of same colour occurs in second quarter, also a dot of the same colour between the two fasciæ. There are a few dark scales before the apex. Cilia concolorous, dotted with brown.

Hind wing olivaceous-fuscous, with a fine yellowish terminal line, whitish above cell, cilia grayish-white; under side grayish-white; under side fore wing darker gray, with spots faintly repeated, cilia light ochreous.

Expanse, 9–10 mm.

Four specimens: Baboquavaria Mts., Pima Co., Arizona, July 15–30, 1903, collected by O. C. Poling.

Tortrix lomonana, sp. nov.

Head smoky-brown, antenna base black; palpi smoky-brown outside, cream colour inside, apical joint black; antenna yellowish-white; thorax black, transversely streaked with white; abdomen and legs light ochreous, latter banded with blackish-brown.

Fore wing: Basal area and a large median costal spot dark fuscous, dotted with black, gray and whitish scales; an oblique middle fascia and large ovate terminal spot white. The outer edge of basal area starts at inner fourth of costa, proceeds obliquely outward to middle of wing, then nearly straight to dorsal margin between inner third and middle; the edge is very finely dentate. The outer dark spot is roughly triangular, on costa it extends from middle to outer seventh; its inner edge is parallel with upper half of basal edge; its lower point is about one-fifth above dorsum and nearly opposite anal angle; the outer edge curves inward at middle

of wing, and the spot is crossed by a line of ochreous-yellow, over which are a few black scales. The upper half of the middle white fascia is rather heavily reticulated with fuscous and dirty white, the former colour starting as three streaks from costa. The outer white patch connects the fascia below the triangular dark spot; it is marked with a few black dots on dorsum, and a streak of faint yellowish scales before the termen. There is a black terminal line, cut by two white dashes below apex, that ends above anal angle. Cilia white, outwardly tipped with fuscous.

Hind wing whitish, reticulated with very light fuscous; under side the same. Under side fore wing smoky-black, paler on costa and dotted with black.

Expanse, 18–19 mm.

Two specimens, Victoria, B. C., Oct. 2, Dr. Wm. Barnes's collection, received through U. S. Natl. Mus. One co-type returned to Natl. Mus.

Phalonia romonana, sp. nov.

Head bleached straw-yellow, faintly darker on sides; palpi same colour, shaded with light brown outside; antenna light gray-fuscous; thorax a shade darker than head; abdomen dark gray, anal tuft tipped with yellowish; legs bleached straw, shaded with blackish-brown.

Fore wing; an inner and outer fascia of shining light pinkish-yellow; a basal patch, central fascia and terminal fascia of dull olivaceous-ochreous. The basal patch extends to inner fifth on costa and dorsum, its edge is irregular but nearly straight, close to base it is overlaid with shining scales. The four fasciæ beyond it are of nearly equal width and nearly parallel edges; the divisional lines are oblique from costa inward, and curved outwardly below costa. There is a conspicuous patch of black scales from end of cell at middle, along outer edge of middle fascia to below fold, with a line of black across fascia, in fold. Beyond this black patch a streak of the dull colour crosses the outer shining fascia, obliquely to anal angle. The dorsal margin is dotted with black between inner fourth and outer fifth. The inner third of costal edge is black, also above the middle fascia, and with two black dots above the outer fascia; there are one or two black dots before termen in middle of wing. The terminal dull fascia is outwardly streaked with shining lines. Cilia concolorous, shining.

Hind wing purplish-gray, cilia whitish; under side paler gray, lightly reticulated with darker lines below costa and before termen. Under side fore wing dark purplish-gray, spotted with dull ochreous on costa, cilia dull ochreous, divided by a broad purplish line.

Expanse, 7.5–11 mm.

Thirty specimens: Essex Co., Park, N. J., August 13 to Sept. 17, Light Trap; Chicago, Ill., Sept., J. H. Reading; Aweme, Manitoba, July 5, Norman Criddle; Plummer's Island, Md., August, A. Busck.

Co-type in U. S. Natl. Mus.

Phalonia nomonana, sp. nov.

Head and palpi dirty white, latter brownish outside; thorax gray and brownish-black; antenna fuscous, basal joint blackish-brown; abdomen and legs yellowish-white, latter heavily powdered with leaden-black.

Fore wing shining brownish-gray. There is a broad central semi-fascia, with parallel edges from inner third of dorsum to upper edge of cell, outwardly oblique, and indented on upper edge outside, colour blackish-brown. This is the only conspicuous mark on the wing. The costa from base to outer third is a darker shade and closely dotted with black; between outer fifth and apex are three or four darker dots. The dorsum is dotted with small blackish spots. There is an obscure streak of reddish-brown from beyond middle of cell to anal angle. There is a blackish narrow terminal line, with a few dark dots before it in the middle of wing. Cilia concolorous, divided by a darker middle line.

Hind wing shining light gray, cilia same, with a darker line near base; under side the same, lightly reticulated before apex. Under side fore wing shining smoky-black.

Expanse, 15 mm.

One ♂ specimen, Carmel, California, April, A. H. Vachell.

Hysterosia homonana, sp. nov.

Head, palpi, thorax and antenna cream-white, outside of palpi, base and upper side of antenna brown. Abdomen and legs light cinereous, latter shaded with brown.

Fore wing: Male costal fold brown; balance of wing creamy-yellow, very sparsely dotted with light brown, and strigulated in outer third with shining white; between these lines the ground colour is a shade darker than on inner half of wing. A purplish-black dot in middle of wing at end of cell. Cilia concolorous. In several specimens the light brown specks are entirely wanting, the wing is immaculate except the brown costal fold, the discal dot and the shining strigulation beyond cell.

Hind wing very light yellowish white, lightly strigulated in some specimens; under side the same. Under side fore wing smoky-brown, costal edge and cilia light ochreous.

Expanse, 19–23 mm.

Twenty-three specimens, Verdi, Nev., June, all collected by Arthur H. Vachell.

(To be continued.)

PRACTICAL AND POPULAR ENTOMOLOGY.—NO. 19.

How Insects are Distributed.

BY L. CAESAR, ONTARIO AGRICULTURAL COLLEGE, GUELPH.

We are all aware that there are many insects in our country to-day that were unknown here a few years ago. Even middle-aged men and women of our farming community can well remember the time when there were no Colorado beetles (potato bugs), no cabbage butterflies, no pea weevils, and no San José Scale to worry their minds. The fact is that the majority of our worst insect pests are not native, but have been introduced either from Europe or the United States, many of the latter coming originally from European or other foreign sources. The following very incomplete list of imported insects will make this point clear: Codling moth, cabbage butterfly, currant worm, Hessian fly, wheat midge, clover weevil, both kinds of asparagus beetles, Colorado beetle, horn fly, Buffalo carpet beetle, house cockroach, most of our plant lice or aphides, white fly, oyster-shell and San José scales, and most of our granary pests and meal worms, as they are commonly called.

Of these injurious insects more than three-quarters have come to us from Europe through the United States, though one of the worst, the San José Scale, has been traced back to China. But even in the case of the European importations, it is probable that many of them had their original home in the still earlier civilized portion of the continents of Asia and Africa, whence they spread to Europe and now have come to us.

How, then, has this world-wide distribution of insects been brought about? To answer this fully is impossible, but some of the chief means have been observed. There is no doubt that trans-oceanic insects have been brought to us through the channel of commerce. On nursery stock, especially before the days of compulsory fumigation, were carried from country to country, scale insects, Aphides (both in the egg and in later stages), borers and other orchard insects or their eggs. On greenhouse plants were carried the particular insects that trouble the floriculturist, such as the red spider, mealy bugs, different kinds of Aphides, thrips, etc. In grain and various kinds of seeds and nuts, and in flour or meal, came the various granary and meal pests. On cattle, swine and sheep were brought the different kinds of flies, lice and ticks that infest these animals. In packed fruit were brought the eggs, larvæ, cocoons or adults of many of the fruit-destroying or other pests that frequent the

orchards where the fruit was packed. In trunks, clothing, etc., were brought house-infesting insects. In fact, whatever insect attacked any particular kind of commodity was almost certain, sooner or later, to be transported with that commodity. We should also remember that ships anchored in a harbour during the time of unloading and loading their cargo form a natural alighting place for the numerous insects that fly around in the air, especially in the warm days and nights of spring and early summer, when the mating season for many is at its height. It is natural to suppose, therefore, that not a few such insects would conceal themselves on board and be carried abroad.

Having thus shown how commerce can convey insects across the ocean, from land to land, let us next consider how we are to account for their wide and rapid spread in any country to which they may chance to have been brought and to have gained a foothold.

We shall first mention some ways in which this is done, independently of man's agency. The first way that would naturally suggest itself is by means of their own powers of locomotion; that is, by flying or crawling from place to place. But in the case of scale insects, which only move about for a day or two in all, and in that time can only traverse a few feet, their spread would be very slow indeed, if they had to trust solely to their own legs to convey them from place to place. Observations have been made, however, which prove that they attach themselves to the bodies of other insects, such as beetles and black ants, and also to the feet and legs of birds, and by these are carried from one tree to another. This would seem the natural explanation of finding, as some of us have, oyster-shell scale on such trees as the red osier dogwood half a mile away from any other infested tree.

A third method of distribution is by means of winds and storms. Gentle and constant winds are of great assistance to insects in enabling them to scent their food at long distances, and, in corroboration of this, it has been observed that they come to their food, in most cases, against the wind. Likewise, a light breeze aids the male insect, by his wonderful sense of smell, to find the female, and thus render the increase of the species more certain. On the other hand, strong winds have often been known to convey such insects as butterflies and moths long distances. Examples of this are the encountering by ships of swarms of butterflies far out at sea, whither they had been driven by the violence of the wind,

and the discovery in Ontario, after three or four days of a strong, steady, southerly wind, of moths, such as the cotton moth, that breed only in the Southern States. Winds, too, often blow young scale insects from the topmost branches of one tree to those of another, or break off infested twigs and leaves and scatter them throughout the orchard. It is worth noting, in this connection, that the strongest and most frequent winds are from the south-west. This fact, to some extent, explains the direction of the spread of our worst insects. It has been observed that, if the San José Scale gets established in the south-west side of an orchard, it will spread over the whole orchard much more rapidly than if it has to begin at the north side and work south.

Closely connected with the action of winds is that of rain storms. These wash many insects from wherever they may happen to be exposed to their fury, and sweep them along, either by themselves or on whatever floating material they may be able to attach themselves to, for long distances in the overflowing rivers and streams, to be cast up at last, still alive in many cases, here and there along the shore.

Some German entomologists, who have made observations on the subject, tell us that the calm, sultry period just before a thunderstorm has a peculiar effect upon insects, causing a strange, nervous sort of activity, and drawing forth from their concealment both sexes. They say, moreover, that Aphides have been observed, during a violent thunderstorm, to crawl to the crown of a plant, and, at the proper moment, launch themselves headlong into the vortex of the storm, to be whirled along possibly for miles.

But, even though these different natural means will account for a gradual and continuous spread of insects, they are far from being the only or even the chief means of distribution. Just as we found that the introduction of transoceanic insects must be attributed to commerce, so also to commerce we must attribute the main part in the rapid spread of insects on land.

Of all the kinds of commerce that have been responsible for the carrying of insect pests from place to place, that in nursery stock has been the chief in the past, before the Government passed a law requiring that such stock should be thoroughly fumigated and disinfected before distribution. It is to nursery stock that we can trace most of the rapid

spread of the oyster-shell, San José and other kinds of scale insects, also of many kinds of Aphides, some borers, and not a few of the other sorts of orchard-infesting insects.

Greenhouses must be held largely responsible for the spread of many small pests, such as the red spider, mealy bug, and Aphides which attack house plants especially. The greenhouse men get these insects on stock received from different sources, and then, by retailing their plants to their numerous patrons, they distribute these troublesome creatures to almost every home in the country. As examples of how easy it is to introduce such insects, and how difficult to get rid of them, may be mentioned the introduction of the chrysanthemum black Aphides, and of the white fly at the Agricultural College, Guelph. Up to three years ago there were no chrysanthemum black Aphides here, but, about that time, Prof. Hunt received some cuttings from one of the United States greenhouses. He examined the cuttings for insects, but so carefully had they concealed themselves, from some cause or other, that he saw none, and supposed the plants free from anything of this sort. A couple of days afterwards, however, when he happened to look at the chrysanthemums he saw many of the black Aphides on them, and, in spite of all his efforts to get rid of the pests, he has hitherto failed to do so. In the case of the white fly, a man living at some distance from Guelph, when on a visit to the college, brought along some leaves of cucumbers to find out what was injuring them. When the Professor had partly opened the parcel, he observed a few tiny insects fly out. He at once closed it tightly and sought to capture the culprits, but in vain. These few escaped individuals have been the progenitors of the numerous white flies that infest many plants around the college greenhouse. Such are merely two examples of many similar ones that every floriculturist could give from his own experience.

Another extensive means of distributing insects is by shipments of fruit. In these times of cold storage and rapid transit, fruit can be conveyed across the continent in a very few days, and whatever insects are to be found in it will have a good chance to arrive at their destination uninjured. Anyone who has ever packed apples knows how impossible it is to prevent at least a few of those infested by codling moth larvæ or other insects being sent in each shipment. The fact is that there is always a possibility of some individuals, of whatever species of insects infest the orchard, getting into the fruit boxes or barrels and escaping uninjured

when the shipments reach their journey's end. This is doubtless the chief means of the distribution of the codling moth which has been so destructive this summer. The larvæ of these, being inside the shipped apples or pears, work their way out from cocoons in the corners or crevices of the boxes or barrels, and, when the fruit has been distributed, these are overlooked and so have a chance to come to maturity, and to emerge in due time and establish themselves in the neighbouring orchards.

Every farmer knows how easy it is to ship pea weevils in seed peas, and so will readily understand that all beetles or moths that infest grain of any sort, flour or meal could easily be distributed in a similar way. That this is the chief means of the wide spreading of such insects there is no doubt.

In connection with commerce, we might also mention, in passing, that it is very probable that great international exhibitions, such as those held in Chicago and Paris, are important factors in the spread of insects, but that any very serious pest has been introduced in this way does not seem to have been proved. Provincial and other exhibitions or fairs also act as distributors, but on a much more limited scale.

Sufficient has now been said to show how very important commerce is as a means of insect distribution. There still remain a few factors that require to be taken into consideration.

If we think over the question we shall find it but natural that in a new country like Canada or the United States, where much land is being brought under cultivation for the first time each year, insect spread should be more noticeable than in older countries, where there are no virgin lands to break up. By this opening up of new districts the balance between insect and plant life is broken. The plants that the insects lived upon are destroyed, and, consequently, the latter are forced to adapt themselves, wherever possible, to the new sources of food provided by the farmer's crops, usually, of course, attacking plants of the same order as those which they had been accustomed to feed upon. Thus a once harmless insect has gradually, or even suddenly in a few cases, changed into an injurious one. This is what happened in the case of the Colorado beetle.

It has, moreover, been found that foreign insects brought into North America become, in most cases, more destructive, and increase more rapidly, than in their native land. There are probably several reasons for this. In the first place, the climate of much of this continent is very favourable to insects. In the second place, our plants, when first attacked

by imported insects, have not had time to acquire that degree of immunity which nature has enabled them gradually to acquire against older and familiar foes; consequently they become an easier prey to these new enemies. In the last place, the parasites and other predaceous insects that kept these pests in control in their native land very often fail to be introduced along with their hosts.

We shall pass on now to the last part of our subject, namely, the intentional introduction by man of beneficial insects to help him in his struggle against the injurious ones. The subject of parasitic insects is attracting a great deal of attention to-day, but is by no means a new subject. We find that for a good many years efforts have been made by entomologists to discover what were the particular parasites that controlled destructive insects in their native countries, and to introduce such parasites to keep in check these same insects when imported. In this way ever year new species of parasites are brought from Australia, New Zealand, Europe, Asia and Africa, to the United States, and *vice versa*. Though most of these have disappointed the too sanguine expectations of their importers, yet several have proved of great service. Of these, two stand out pre-eminently, namely, *Vedalia cardinalis* and *Scutellista cyanea*. The former is a species of ladybird beetle introduced from Australia to combat the white scale that was destroying the orange trees of California, the latter is an insect from South Africa meant to combat the black scale. Both have worked wonders in controlling the ravages of these respective pests. We have, of course, in our own country, many native species of parasites or predaceous insects, such as several kinds of ladybird beetles, Ichneumon flies, Aphis lions, etc. These are distributed throughout the country, either along with their host insects, or in similar ways to those mentioned above.

Though this subject of insect distribution is far from being exhausted by what has been said, it is yet hoped that the different points dwelt upon may awaken a new interest in insects and the insect world among those who, though not trained entomologists, are yet lovers of nature in her different phases. It may interest such to mention that with the marvellous increase of commerce between all countries of the globe, and the bringing of continent into close contact with continent, by the ever-increasing speed of ocean vessels, the time appears to be rapidly approaching when practically all insects will, so far as climate will permit, become cosmopolitan.

A REVIEW OF OUR GEOMETRID CLASSIFICATION.—No. 3.

RICHARD F. PEARSALL, BROOKLYN, N. Y.

The endeavour to place our species under genera based upon structural characters, easily observed, yet possessing stability, has resolved itself into an extensive study and rearrangement of the species themselves, especially of the type forms, which in a number of cases are found to differ from the generic requirements. I need not rehearse here the opinions set forth by Mr. Meyrick, Dr. Hulst and others as to the propriety of using certain characters, whether sexual or not, in defining genera. I have simply, through my own investigations, sought to determine upon the value of those which in our fauna I have tested and found to be reliable, and these I intend to use in future descriptive work, dividing them into *basic* and *auxiliary* groups.

Basic Group.

In this group the characters do not vary as between individuals, except in rarely aberrant forms, which will be noted.

The antennæ. They may be filiform, flattened (⌓), compressed (▽), unipectinate, bipectinate, serrate, lamellate, or dentate, and smooth, ciliate, fasciculate, or spinose. They generally differ between sexes of the same species.

The palpi vary in length of joints often between sexes of the same species, but not between individuals of the same sex. Their position is not given, since it is not always natural after death. The comparative terms used to describe them may be thus limited as nearly as is possible:

Short, when looking downward vertically their tips are not, or are just visible beyond the front.

Moderate, when they project beyond the front equal to the width of it between the orbits.

Long, when they exceed that limit.

The frontal tubercles and tufts.

The tongue.

The claws on fore tibiæ.

Veins 5 and 8 of hind wings, the former by its presence or absence, the latter by its connection with or separation from the discal cell, are important divisors of families, as well as genera.

The frenulum.

The tibial spurs.

The hair pencil on hind tibiæ of male. Dr. Hulst used this as a reliable factor, and my experience fully warrants the value he placed upon it.

AUXILIARY GROUP.

The characters here classed are not to be wholly relied upon. Many of them will be used as useful aids, but will be omitted where found too unstable.

The tufts of thorax, abdomen, and *patagia,* chiefly because of their liability to removal by abrasion. The same might seem applicable to the hair pencil, but in only one genus (Epimecis) have I had any difficulty with it.

Venation (except veins 5 and 8 of hind wings).

The foveal gland beneath wings. In some Ennominæ it is well developed, in others difficult of detection, or absent, and thus falls without the pale of fixed characters, but is useful in defining certain genera.

The accessory cell. The extensive use which has been made of the accessory cell by Dr. Hulst in the separation of Geometrid genera, following the assertion of Mr. Meyrick that it was an invariable structure, seems not to be warranted, at least so far as the American fauna is concerned. Selecting species in which I have considerable material, I give the result of an investigation, which it was not necessary to extend because here is enough evidence to effectually debar its future use. Of *Cladara atroliturata,* Walk., which, according to Hulst, should have two acc'y cells, out of 58 examples tested, 56 were normal and *two* had only one cell. Of *Nyctobia limitaria,* Walk., 158 examples divided as follows: 28 had one cell, 21 had *one* cell in one wing and *two* in the other, while 109 were normal. Of *Tephroclystia latipennis,* Hulst, with one acc'y cell, 16 examples separated thus: 9 with *one* cell, 7 with *two* cells. Here the anomaly is shown, viz.: 9 specimens with one cell would go into the genus *Tephroclystia,* while the other 7 of the same species would fall into *Eucymatoge,* an impossible situation, hence I have abandoned its use almost entirely, and by so doing it becomes imperative that there be a rearrangement of the genera and species of Hydriomeninæ.

(To be continued.)

NEW SPECIES OF NORTH AMERICAN LEPIDOPTERA.

BY WM. BARNES, S.B., M.D., DECATUR, ILLINOIS.

(Continued from page 68.)

Grotella calora, n. sp.

Beneath, fore wing quite uniformly fuscous. A small obscure blotch on costa before apex. Hind wing smoky, paler inwardly, centre dark. Mesial band common to both wings. Pale discal mark on hind wing. Face brownish. Head and thorax white. Abdomen concolorous with hind wing.

Types Redington, Ariz.

This species is much smaller than *septempunctata*, with outer row of spots farther out. These together with the dark secondaries will easily serve to distinguish it. The black points in this species are usually quite small and show a tendency to disappear.

Specimens from Argus Mts., which I take to be the same species, show in some specimens an almost entire disappearance of the spots.

Grotella sampita, n. sp.—Expanse, ♂ 22 mm., ♀ 24 mm.

Fore wing chalky white, with black spot on costa at base, with a second one just below it. Black spot on costa at junction of inner and middle third, another one on inner margin opposite to it, a third in middle of wing, internal to the other two. Second row of black spots across wing at end of cell, the row being slightly outcurved and composed of four spots, one on costa, the second slightly below it, one on inner margin, the second slightly above it. This band begins at about the junction of middle and outer thirds of costa. A well-marked row of intervenular terminal black points. Fringe white. Secondaries pale fuscous, almost white along inner margin. Faint discal bar. Fringe white, with well-marked row of black points at base. Face black. Head and thorax white, the latter slightly creamy.

Beneath, fore wings evenly fuscous. Fringe white with fuscous spots at base. Hind wing white, with distinct discal dot, with rather broad fuscous band along costa. Terminal fuscous broken line at base of fringe.

Types ♂ and ♀, Colorado and Southern Arizona.

Grotella binda, n. sp.—Expanse, ♀ 24 mm., ♂ 20 mm.

Ground colour white, with very faint yellowish tinge. Black dot on shoulder and one on costa at base. T. a. line represented by a row of

black spots, irregular in size and shape, usually about four in number, the one on costa somewhat larger than the others, the third one club shaped. A spot on costa in middle of wing and one at end of cell. T. p. line represented by a row of spots, irregular in shape and size, outwardly curved beyond cell, thence somewhat inwardly curved to inner margin. The spot on costa is considerably larger than the others and close to it on outer side is another similar in shape and size, with some black scales below it. A well-defined black terminal band evenly and neatly cut by pale at end of veins. Fringe slightly darkened. Hind wing soiled whitish fuscous towards apex, narrowing out as it approaches inner margin. In the female the whole wing is slightly darkened with fuscous. Fringe white.

Beneath, fore wing yellowish fuscous, white along inner margin, narrowly yellowish along costal edge. Yellowish patch at apex, followed by a rather narrow yellowish subterminal band. Terminal black band as above, cut with yellow. Hind wing white, with broad even yellow band along costal edge. Face slightly yellowish. Head and thorax whitish.

Type ♂ and ♀, Santa Catalina and Chiricahua Mts., Ariz.

Stibadium olvello, n. sp.—♀. Expanse 28 mm.

Fore wing, light and dark shades of olive brown, the median portion of wing darker, the costal and beyond s. t. line paler. The usual preapical triangular patch of the same shade as the median portion of wing. Three silvery white marks, as follows: first, a small spot at inner portion below costa, second, a large subquadrangular patch just beyond that in centre of wing, with a small sharp inward projection at the inner side. The patch occupies about one-half the width of the wing at the inner third. The third patch is external to and above the second at the end of cell, is crescentic in shape, with the concavity upwards. S. t. line rather paler than ground color, with rather sharp angular curve beyond cell, thence quite even to inner margin, following line of outer margin. Fringe concolorous with a slightly darker basal and somewhat lighter mesial band. Hind wing white, with a very faint yellowish tinge and slightly shaded with olivaceous along outer margin. Fringe concolorous with basal portion. A very slight trace of discal bar.

Beneath, fore wing darker centrally, slightly paler along costal, external and inner margins. Fringe darker. The silvery spots from above are indicated as paler patches beneath. The hollow of the crescent being filled with darker scales than any other portion of the wing. Hind

wing pale, slightly stained along inner and outer margins. Head, collar and thorax concolorous with fore wing. Abdomen more yellowish.

Type one ♀, Southern New Mexico, September 1st, from Mr. Poling.

Plusiodonta amado, n. sp.—Expanse 25 mm.

Ground colour grayish brown, with a slight violaceous tinge, shadings from dark yellowish brown to brassy yellow. A dentate line across base of wing, irregular, broken, shaded with deep brown internally. T. a. line strongly toothed, teeth filled with dark brown externally, internally with golden yellow or brassy yellow shading. The space between basal and t. a. line shaded with brown centrally, the upper portion mostly covered with brassy yellow scales not quite so metallic as those in *compressipalpis*. The brown shading following t. a. line is separated sharply from the violaceous central portion of wing, which runs down into the tooth on inner margin. The outer portion of the violaceous area is limited by a brownish line with a marked rounded outward projection in centre of wing; it starts some two or three mm. before apex and terminates just beyond tooth on inner margin, it is accompanied on the outer side by a second brown line parallel to it through upper two-thirds of wing, but which diverges towards inner angle in lower third. The space between the lines is more or less thickly coated with brownish scales. Beyond the t. p. line there is a yellowish brown shade, rather narrow in upper two-thirds of wing, thence broadening out to inner angle. The terminal space is violaceous, with a dark brown patch just below apex. A terminal row of brownish bars between veins, fringe concolorous with terminal area. The reniform can be made out as an indefinite pale ring with darker centre. Hind wing fuscous, fringe concolorous, with darker broken line at base.

Beneath, wings pale yellowish brown, fore wing darkened centrally. Indications of mesial band. Hind wings somewhat more yellowish along costa, with faint traces of mesial band. Head and thorax coated with an admixture of violaceous and brown scales. Abdomen concolorous with hind wing.

Type one ♀, Babiquivera Mts., Ariz., August.

Cirrhophanus papago, n. sp.—Expanse 28 mm.

Fore wings yellow, with orange yellow markings, veins darkened. T. a. line well marked, rather broad, with well-marked outward curve. T. p. line outwardly curved beyond cell, thence with gentle inward curve to inner margin. Fringe concolorous. Hind wings fuscous over yellow

in superior half, inner half more yellowish, fringe yellowish. Head, collar and thorax orange yellow. Abdomen more brownish yellow.

Beneath, fore wings blackish centrally, yellow along costa, inner margin, and more broadly so along outer margin. Hind wings paler yellow.

Types ♂ and ♀; Southern New Mexico, September, from Mr. Poling.

Ogdoconta moreno, n. sp.—Expanse 28 mm.

Ground colour a rather pale olive over a whitish base. Basal line faintly indicated on costa. T a. line pale, accompanied by outer darker shade, almost transverse, with a slight outward curve. T. p. almost directly across wing at junction of outer and middle third, following outer border, pale with an accompanying inner dark line. S. t. pale, irregular. Terminal row of intravenular lunules, not very distinct. Fringe a trifle paler than ground colour. Rather poorly defined pale spots mark the position of the orbicular and reniform. The median space is a trifle darker than the subterminal and terminal. Hind wing pale fuscous, darkening outwardly, fringe paler.

Beneath, fore wings fuscous centrally, paler beyond the rather faint mesial band. Hind wing paler than fore, somewhat darkened along costa and outer third. Well marked mesial band, extending almost across the wing. Head and thorax concolorous with fore wings, abdomen with hind wings.

Types ♂ and ♀, Babaquivera, Huachuca and Chiricahua Mts., Ariz., August.

Erastria ondo, n. sp.—♂. Expanse 26 mm.

Ground colour a pale brown, with slight yellowish tinge. Fore wings crossed by three lines, the first from costa somewhat before middle to inner margin at junction of inner and middle thirds, with short acute angle at costa, even and rigid through rest of course, somewhat darker shade than ground colour and accompanied by a slightly paler outer shade. Second line sub-parallel to first, beginning just before apex, reaching inner margin at junction of middle and outer third, brown, with outer pale accompanying shade. The third which represents the s. t. line, pale, somewhat wavy, following outer margin. Dark points on veins terminally. Fringe concolorous, with pale line at base. Reniform represented by a few blackish scales. Hind wing pale yellowish fuscous, with slightly darker terminal line. Fringe concolorous. Head and collar yellowish brown. Thorax and patagia somewhat paler. Abdomen yellowish fuscous.

Beneath, fore wing fuscous centrally, yellowish along costal and outer margin. Hind wing whitish centrally, yellowish along costal and outer margin, with faint discal spot and mesial band.

Type, Huachucá Mts., Ariz.

Isogona acuna, n. sp.—Expanse 28 mm.

Ground colour pale brownish yellow. Head and collar dark umber brown. Thorax and abdomen concolorous with wings. Ordinary markings rather faint lines running same as in other species of the genus. T. a. line with inward tooth on cell, thence inwardly oblique to inner margin. Median shade very faint. T. p. slightly wavy towards inner margin, angled opposite cell as in other species. The projection from angle to apex faint though traceable. S. t. line pale, irregular, barely traceable, except towards costa. A few blackish scales on inner margin in subterminal space and a black point above them. The apical triangle only slightly darkened. Reniform moderate in size, concolorous, with narrow defining, slightly darker ring. Orbicular scarcely to be distinguished in the specimens before me. Fringe slightly darker than wing, with dark line at base, followed by a slightly paler one. Hind wing concolorous with fore or a trifle paler. Well marked dark mesial band, followed by more or less evident dusky shade.

Beneath, fore wings uniform even pale brownish yellow, with no traces whatever of any marking.

Type, Babaquivera Mts., August, Redington, Ariz.

Isogona segura, n. sp.—Expanse 28 mm.

Wing form and general type of maculation same as *natatrix*. The colour has, however, somewhat more of a reddish cast. The t. a. line, instead of being even and rigid, is dentate, having three well-marked teeth. Orbicular a well marked black point, smaller and blacker than in its ally. Median shade and reniform about the same in the two species. The triangular patch on costa, before apex, considerably darker brown than rest of wing. T. p. line and spur running to apex, not quite so heavy. The crenulate subterminal line and pale line at base of fringe about the same, as is also the minute black point before inner angle. The space beyond t p. line somewhat darker than rest of wing. The wing is also darkened somewhat in the angle of t. p. line. Hind wing concolorous with fore. Mesial band not quite so well marked as in *natatrix*. A broad dark shade following mesial line. Palpi, head and collar dark blackish brown. Thorax and abdomen concolorous with wing. Beneath,

rather uniform pale yellowish brown, with very faint traces of common mesial band.

This species can be recognized at a glance from *natatrix* by the strongly dentate t. a. line, from *Parora Texana*, with which it has been confused, by the character of t. p. line and reniform. In *segura* the t. p. line is even as in *natatrix*, not crenulate and wavy as in *Texana*.

Types, Babaquivera Mts., Ariz., July.

Eudela helveta, n. sp.—Expanse 18 mm.

Head, thorax and wings yellow as in *mendica*. Fore wing with broad, semi-transparent fascia, almost reaching costa before apex and inner margin before inner angle. The margins are quite even. A large semi-transparent patch in base of cell, with another about twice as large below it, only separated by vein. Hind wing with broad semi-transparent fascia occupying about one-third of the wing. Under surface as above.

Types, two ♂, Kerrville, Texas.

RECORDS OF DIPTERA FROM LAKE TEMAGAMI, ONT.

BY JAMES S. HINE, COLUMBUS, OHIO.

Mr. Frank B. Shuler, of Hamilton, Ohio, while with a camping party on Lake Temagami, Ontario, during the past summer, collected a number of species of Diptera, some of which are worthy of note as matters of record.

Of most interest is the discovery of a second species of the genus *Mesembrina* for North America. It agrees so well with the European *M. mystacea* that I have given it that name.

The nearctic species of this genus have not received much consideration, but Hough has given a short account of the results of his studies in Vol. I of the Biological Bulletin. He is of the opinion that we have only a single species of the genus, and this he determines as *M. Latreillei*, of which he makes *resplendens* a synonym.

The specimen I have called *mystacea* is larger than *Latreillei*, fully 15 millimetres in length and quite robust, the thorax is clothed above with golden-yellow pile, and so are the last two segments of the abdomen, but on the latter the colour is lighter than on the former. The apical cell of the wing is not so widely open, and the sides of the face are yellow instead of silvery. Some of the older authors placed *mystacea* in the Syrphidæ, and I must confess the specimen before me looks very much

like one of those flies from superficial examination. In fact, I took it for a Syrphid myself until I examined the wing venation.

The following species are represented in the collection :—

TABANIDÆ.

Tabanus actaeon, astutus, epistatus, microcephalus and nivosus; Chrysops excitans and frigidus.

BOMBYLIIDÆ.

Anthrax alternata, fulviana and lateralis.

SYRPHIDÆ.

Syrphus arcuatus, diversipes, ribesii and xanthostoma; Xanthogramma felix; Sphaerophoria cylindrica; Eristalis dimidiatus; Helophilus latifrons and similis; Xylota fraudulosa.

CONOPIDÆ.

Physocephala furcillata.

TACHINIDÆ.

Gonia capitata; Echinomyia algens; Panzeria radicum.

DEXIDÆ.

Ptilodexia tibialis.

SARCOPHAGIDÆ.

Lucilia Cæsar.

MUSCIDÆ.

Mesembrina mystacea.

ON THE CORNICLES OF THE APHIDÆ.

BY J. R. DE LA TORRE BUENO, NEW YORK.

Among the many interesting matters discussed at the New York meeting of the Association of Economic Entomologists, the question of the source of the so-called honey-dew of the Aphides was touched upon by some of the members present, and doubts were freely expressed as to its being ejected at the cornicles, although so stated in the majority of works. By a curious coincidence, I received, from Professor Geza von Horvath, of Buda-Pesth, a separate of a paper he published, in 1905, on the matter, (Sur les cornicules ou nectaires des Aphidien, C. R. 6me. Congr. intern. de Zool.), of which what follows is an abstract.

The learned Hungarian briefly mentions the nature, position and dimensions of the tubes, and then proceeds to review the opinions of Reaumur, Bonnet, Linné, to whose great authority he attributes the prev-

alence of the notion that the Aphides eject the honey-dew through the cornicles; Kyber, Kaltenbach, Forel and others, who held to the views of Bonnet.

It can, however, be easily ascertained that the honey-dew is excreted exclusively through the anus and never by the cornicles. When an ant strokes an Aphis with its antennæ, a clear drop appears, always at the end of the abdomen, whilst the cornicles excrete nothing. On the other hand, if an Aphis be picked up in the fingers, or if it be touched with a straw, a tiny drop at once appears at one or both cornicles, which is always coloured.

Certain authors have held that these appendages formed part of the respiratory system, a theory clearly erronerous. Witlaczil has even thought that they appertained to the urinary system, but, on the one hand, the product of the basal glands of the cornicles does not show any of the uric acid reactions; and, on the other hand, Kowalevsky has demonstrated that in the Aphides the end of the intestine is functional as an urinary organ in the absence of the Malpighian tubes. Professor Knor's analysis, published by Büsgen, proved that the viscous liquid excreted through the cornicles is a waxy substance.

"In order to understand the object of this waxy matter, one should observe a colony of living Aphides. It can then be seen that the colony rids itself of its excreta through the anus in the form of clear drops, especially when they are stroked by their friends the ants; during this operation their cornicles are quiescent and inactive and show no change. But if an aphidophagus insect, particularly a Coccinellid or the larva of a Chrysopa, approaches a plant louse, the latter puts out at the tip of one or the other cornicle a tiny viscous drop, aims the cornicle towards its enemy and endeavours to apply the drop to the head, the jaws or the thorax. If this manœuvre is successful, the enemy retires at once and does all it can to rid itself of the adherent drop, which dries at once, and which is apparently extremely disagreeable to it." Hence Dr. Horvath defines the cornicles thus:

"The cornicles of the Aphides are the excretory canals of wax-producing glands differentiated in a special manner, and the product of which is a means of defence against the Coccinellidæ and the Chrysopidæ."

Those unfurnished with cornicles do not need this protection, since some live underground and others are covered with a waxy secretion. There are few Aphides unprovided with either of these means of defence.

NOTE ON PLATAEA CALIFORNIARIA, HERR.-SCH., AND ITS ALLIES.

BY GEO. W. TAYLOR, WELLINGTON, B. C.

Two species appear to be confused in our recent lists under the name *P. Californiaria*. The one species is properly entitled to the name, the other is the *Gorytodes uncanaria* of Guenée.

Packard in one of his early papers[1] describes *uncanaria* from Californian specimens, but amongst them he had evidently a specimen of *Californiaria*, for that is the insect he figures in the photographic plate[2] accompanying the article.

In the course of his description, too, he makes occasional reference to differences shown by certain specimens, which are just the differences that are seen in comparing the two forms.

In the monograph[3] the same confusion exists. The description is mainly *uncanaria*, while the figure is *Californiaria*.

In this work *Californiaria* is placed as a synomyn of *uncanaria*, although it is really the prior name.

Henry Edwards[4] was the first to point out the fact that we have two species here, but he, taking it for granted; I suppose, that *uncanaria* properly included *Californiaria*, Herr.-Sch., renamed the latter form *personaria*. He points out the differences very clearly, and they can be readily seen if the two species are placed side by side.

In *Californiaria* (=*personaria*) the intra-discal line runs from the costa to the base of vein 2 before turning towards the inner margin. In *uncanaria* it runs in a straight line to the base of vein 3. In the first named the discal spot on the fore wing is *black*, in *uncanaria* it is black pupilled with a lighter shade; and in the third place in *Californiaria* the median band is much narrower on the costa and much more deeply toothed on its outer edge than the corresponding band in *uncanaria*.

A third species belonging to the same group in the genus is *P. diva*, Hulst. This agrees in wing shape with *uncanaria*, but is very different in colour, being (if I have rightly identified my specimen from Hulst's description) a very dark gray, with a much more regularly scalloped extra-discal line than has *uncanaria*, and with the dark submarginal shade on

(1) Proc. Bost., Soc. Nat. Hist., XVI, 221.

(2) Plate I, fig. 24.

(3) Page 201, pl. IX, fig. 32.

(4) Papilio, vol. 1, p. 120.

the fore wing *following* the faint submarginal white line instead of preceding it as it does in both *uncanaria* and *Californiaria.*

Our species should stand as follows:

(1) Plataea Californiaria, Herr.-Sch.
=personaria, Hy. Edw.
(2) P. uncanaria, Guenée.
(3) P. diva, Hulst.
(4) P. trilinearia, Packard.
=? dulcearia, Grote.

Californiaria seems to be widely distributed in the State, and to be common in April and May.

Uncanaria is not so common. My specimens were taken in Sonoma County in May.

Diva is rare in collections. The type was from the Argus Mountains (Riley), and my own specimen was received from Mr. F. Grinnell, who took it on the San Bernardino mountains, at an elevation of 8,500 feet.

Trilinearia is the most abundant form. Dyar's list gives Texas, Colorado, Arizona and Nevada as localities, and I can add to these California, Kansas, British Columbia and Alberta.

Dulcearia, Grote, is placed by Hulst as a synomyn of *trilinearia*, and probably quite rightly. Grote, however, says that the two can readily be distinguished, and I must say I have never seen a specimen quite agreeing with Grote's diagnosis. Possibly Grote may have been misled by the very faulty figure in Monograph.

The *Cleora demorsaria* of Strecker,[5] which is placed in the genus *Plataea* by Hulst, is said by Dr. Dyar to be based on a specimen of *Spodolepis substriataria*.

A NEW CANADIAN SPECIES OF COPIDOSOMA.

BY L. O. HOWARD, WASHINGTON, D. C.

The little Chalcidid parasites of Lepidopterous larvæ belonging to the genera Copidosoma, Litomastix and Ageniaspis, are of especial interest at this time, on account of the extraordinary discoveries in the development of these forms that have been made by Marchal and Silvestri. Mr. H. H. Lyman some time ago rearing a number of specimens of one of these insects from the larvæ of *Anacampsis lupinella*, Busck, taken on a species of Lupinus at Toronto, sent the reared specimens to the Depart-

(5) Lep. Rhop. Het., suppl. 2, p. 9.

ment of Agriculture, at Washington, and Doctor Ashmead gave them the manuscript name of *Copidosoma Lymani*, n. sp. Dr. Ashmead's sad and serious illness has stopped his work surely for a long time to come, and, at Mr. Lyman's request, I have described the new form, and submit the description as follows :

Copidosoma Lymani, n. sp.—Female. Length, 0.92 mm.; expanse, 2.1 mm.; antennæ inserted quite at the mouth corner; cheeks about as long as the eyes; vertex slightly rounded above eyes; front well rounded. Facial depression beginning opposite lower third of eye, and continuing somewhat divergently to mouth border; a median carina beginning dorsad with a smooth, elevated tubercle, which is not distinct on its ventral aspect, and widening slightly towards mouth border. First funicle joint one-third length of pedicel and narrower; other funicle joints gradually increasing in length and extremely gradually in width. Face and notum, including tegulæ, finely shagreened; mesopleura faintly striate. Head and mesonotum metallic bluish-green; mesoscutum brown, with brownish metallic reflections; mesopleura dark metallic purplish, brownish and bronzy caudally; antennal scape, dark brown, lighter at extremities; flagellum dark honey-yellow, darker at joints; abdomen shining black; all femora brown; front tibiæ and all tarsi light yellowish; middle tibiæ brown near base; hind tibiæ with basal half brown.

Described from nine specimens. Host, *Anacampsis lupinella*. Habitat, Toronto, Canada. Collector and breeder, H. H. Lyman. Type No. 9779, U. S. National Museum.

CHIONEA VALGA IN MINNESOTA.

On page 275, August, 1906, CAN. ENT., is an article from C. N. Ainslie, of Rochester, Minn., somewhat discrediting the finding of *Chionea valga* in Minnesota previous to his finding it in December, 1905.

I am just in receipt of a letter from Prof. J. M. Aldrich, in which he says that he has in his collection a specimen of this insect with Dr. Lugger's label on it. Further, that he distinctly remembers seeing, in Lugger's collection, in 1888, at least two more specimens of this insect. It would seem, then, that Dr. Lugger was justified in figuring it in his Second Annual Report, and that it was found in Minnesota previous to 1905.

In making up our report for 1905 on the Diptera of Minnesota, we used a figure found among the cuts here, drawn by Miss Houenstein, which Dr. Lugger evidently intended to use had he lived to carry out his plans.—F. L. WASHBURN, State Entomologist, St. Anthony Park, Minn.

THE OCCURRENCE OF ACHLARUS LYCIDAS AND LAERTIAS PHILENOR NEAR BOSTON, MASS.

During the three years prior to 1904, I collected very frequently in the Middlesex Fells Reservation, which includes parts of Malden, Melrose, Medford, and Stoneham. I found *A. lycidas* quite common, and in company with *Epargyreus tityrus*, on red clover blossoms at the south side of the Fells Reservoir and along the driveways near it. The single remaining specimen of my captures from this locality is dated June 17, 1902. I do not remember taking it in any other locality, but Mr. J. H. Rogers, Jr., stated at a recent meeting of the Cambridge Entomological Club in Boston, that it was quite common in Medford. Mr. H. H. Newcomb, President of the Club, said that the occurrence of this species in this locality had long been known to Boston entomologists.

While I have probably seen *Laertias philenor* flying, I have never yet taken it in Massachusetts. Mr. W. L. W. Field, in a short article on Varying Abundance of Certain Butterflies, published in Psyche, Vol. XII, p. 76, remarks: "*Laertias philenor* appears occasionally in great numbers in the neighbourhood of Boston, but after a season of plentifulness it vanishes." C. A. FROST, South Framingham, Mass.

Mr. Harris's query as to *Papilio (Laertias) philenor* and *A. lycidas*, on page 68 of the February issue of the ENTOMOLOGIST, is just noticed. There is nothing unusual in either of these at Melrose, Mass. *Philenor* has been taken by me at Bar Harbor, Maine; it has been very common for years in the swamps near Greenwich, Conn., and I have twice seen it in the Berkshires. It naturally follows several introduced plants.

While writing, I wish to add Winnetka, Illinois, just north of Chicago, as an unreported locality for *Terias delia* and *Pamphila Aaroni*.

EUGENE MURRAY AARON, Chicago.

BRITISH COLUMBIA BRANCH—ENT. SOC. ONTARIO.

The sixth annual meeting was held in Vancouver on the 25th of January. The election of officers resulted as follows: *President*, Rev. G. W. Taylor; *Vice-President*, Mr. A. S. Bush; *Secretary-Treasurer*, Mr. R. V. Harvey.

Mr. Harvey reviewed the work of the past year, and pointed out the value of the "Bulletin" as a permanent record of that work. He referred to the difficulty encountered by members in having their Hymenoptera and Coleoptera determined, and suggested that an effort should be made this season to obtain a more complete knowledge of local Coleoptera. He also asked for more hearty co-operation in keeping up the Bulletin.

A discussion on labels followed, and it was recommended that green paper be used for all Vancouver Island labels, and rose-colour for Vancouver city and neighbourhood. Mr. Bryant described his collecting experiences on the Stikine and Taku rivers. A spring meeting will be held at Duncan's about April 10th.

Mailed March 7th, 1907.

The Canadian Entomologist.

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HABITS OF SOME MANITOBA "TIGER BEETLES" (*CICINDELA*).

BY NORMAN CRIDDLE, AWEME, MANITOBA.

This paper is the result of two years' study and a number of years' collecting in the neighbourhood of Aweme, Manitoba. It has no pretence of being complete in all details or of taking in all the forms inhabiting the Province, a very small portion of which has yet been collected over. The species and varieties mentioned, with the exception of *hirticollis* and *pusilla*, have been under personal observation, and all have been collected within twelve miles of Aweme, which is in latitude 49°, 42'; the height above the sea averaging about 1,180 feet.

In working up the habits of these insects I have received much valuable information through the generous assistance of Prof. Wickham, to whom my grateful thanks are due. I am also under deep obligation to Mr. E. D. Harris for supplying me with much information.

The species are arranged according to Dr. W. Horn's Index.

In habits, the Manitoba, and probably all the North American species, could be divided into two groups; namely, those which hatch out in August, or thereabouts, and hibernate, and those species, such as *lepida*, which appear from pupæ towards the end of June and die before winter sets in.

This somewhat interesting difference in habit has not, so far as I am aware, received any marked attention, though I am inclined to believe that it has been a factor of some importance in the modification of a number of species.

The individuals of the first of these groups, at the approach of winter, search out a suitable situation and excavate a hole in which they pass the winter. The depth of burrow varies considerably with the different species, and even to a marked extent in forms that are classed as subspecies. The choice of a locality for hibernation varies according to the species, but all seem to prefer a situation in which there is a slant facing the south, so that they get full advantage of the sun. In investigating the methods of hibernation I have found that a shallow hole dug in the

vicinity of a Cicindela locality always proves productive, and that large numbers will congregate from all parts to seek their winter homes in such places. The hole, however, should be dug a month or more before the hibernating season commences.

In digging, the beetles loosen the earth with their mandibles, and use one leg at a time when kicking the earth back. For the first three to eight inches the hole is dug at an angle, after which it usually goes down in an almost perpendicular direction, though it often happens that when starting after an interval of rest the beetles will take a slightly different direction, so that the hole is never straight, but turns first one way and then another. For the first six to fifteen inches the earth is thrown out, but after this depth is reached the hole is gradually filled in moderately tightly. From four to ten inches being left unfilled at the bottom to enable the beetle to work its way out.

The hole is nearly always wide enough at all points to allow the beetle to turn round, and is always so at the bottom. When the hole is completed, the beetle turns round and faces the top, ready for digging its way out the next spring, when it emerges in practically as perfect condition as when it went in.

A few species, and these closely related, probably dig below the usual frost line, but many do not, as I have dug out several kinds that were in the solid frozen ground and were quite motionless, and which took fully half an hour to become even moderately active in a warm place. All the hibernating forms become sluggish, and eventually torpid as the earth gets cold and frozen.

There are, no doubt, many belonging to this group that never leave their winter homes, especially those kinds that inhabit localities close to water. In fact, it is by no means an uncommon occurrence to find dead specimens of the previous year when digging out live ones. Hundreds were found hibernating in 1906 only five feet above low-water mark in the banks of the Assiniboine River, which the rise of the water in the spring would almost surely totally destroy.

The second of our groups contains strictly summer species, which do not pass the winter in the imago stage, but only as larvæ, possibly as pupæ or ova. There are, however, in the United States some species that are probably intermediate between the two groups, which either pass the winter in very shallow holes or under stones, fallen trees, etc., but these, though difficult to distinguish from the summer species, strictly belong to our first group.

In no case can I find any evidence to warrant the belief that any of our native forms are double-brooded, and it seems highly probable that the same could be said of all North American Cicindelidæ. From my investigations I was inclined to think that no specimens emerged from pupæ in the springtime, but Mr. E. D. Harris writes that he has collected specimens in the early spring that "bear unmistakable evidence of very recent emergence from the pupa condition," and he suggests that these are belated specimens which failed to appear at the usual time in the early autumn.

I can give little information as to the habits of the larvæ. Most of, and probably all, the Manitoba Cicindelas pass one winter as larvæ, and indications point in some cases to two winters being passed in this condition. Unfortunately, I am unable to write with exactitude in this matter, but think it well to draw attention to the subject.

The larvæ are by no means the helpless creatures out of their holes some writers think. They can crawl readily, and, undoubtedly, in some cases leave one hole and dig another. At the approach of winter they commence deepening their holes, and, like those of the beetles, when completed the holes vary in depth with the different species. In digging, the insects loosen the earth with the mandibles, and then shove that flat shovel-like structure of the head and prothorax under the loosened earth until sufficient has been received to make a load, when the insect turns round and works its way up, holding the "shovel" in a horizontal position, until it gets level with the top of the hole, when the head and "shovel" is suddenly jerked backwards, which throws the earth two or three inches away. Larvæ that were watched took from 70 to 113 seconds between each load of earth when the holes were about 14 inches deep.

The plates of the head and prothorax form a most interesting structure, which has apparently been specially modified for the purpose of digging and carrying earth to the surface.

For the first portion of the season most of the work is done at night or in the evening and early morning, but as the season advances digging is also done in the daytime, especially if the weather is cold. Usually larvæ are found digging a week or more later in the season than the imagoes. As the holes get deeper the sand becomes gradually piled up so that the insects are unable to throw it so far away, and at last the earth, by rolling back, blocks the entrance, though not, I believe, until the correct depth has been attained, as in some cases the hole is built up

through the loose sand. When finished the hole is usually blocked near the top, and in some cases further down, after which the larva retires to the bottom for the winter.

To a beginner the holes are much like those made by a burrowing-spider, for which they usually pass. They can, however, be at once distinguished from these by the absence of web at the entrance, and nearly always by the formation of the heaps of sand thrown out. Those of spiders are nearly always in a complete circle, while those of *Cicindela* larvæ are either in one heap or in two opposite each other.

The larvæ are always enormously abundant in comparison with the beetles, which shows that large numbers must perish, though by what means I am unable to say.

The beetles are sometimes destroyed in large numbers by badgers.

The habits of each species, sub-species or aberration follow under separate headings.

Cicindela formosa, aber. *Manitoba*, Leng.—The largest of our Manitoba tiger-beetles. This form is not very well differentiated from *generosa*, and I have specimens of both before me that I am only able to separate with difficulty, though with the average specimen *Manitoba* is easily distinguished by the broadness of the elytral markings, which in some cases cover nearly two-thirds of the elytra. Some specimens also run rather closely to *formosa* in colour and markings. In newly-hatched specimens the anterior portion of the elytra is sparsely clothed with fine hairs.

These handsome beetles are strong fliers. They usually inhabit the edges of sandy blow-outs where the vegetation is straggling and far between. The new brood appears about the second week in August, and is overlapped by the old brood to the extent of about ten days.

Manitoba is among the earlier kinds to commence winter quarters, choosing much the same locality as *limbata*, but in places rather more sheltered. For depth of hole this form stands out alone. The average depth of burrow from the entrance is 38 inches, in soft sand the depth is about 44 inches. The deepest hole measured was 47 inches, and the shallowest 25. Larvæ holes that probably belonged to this form were from 30 to 48 inches deep. They were in rather denser vegetation than where the beetles are usually found, but were close to blow-outs inhabited by *Manitoba*.

Manitoba has been noted feeding upon *Disonycha quinquevittata*, and upon other *Crysomelidæ*, as well as upon ants.

Cicindela venusta, Lec.—Dry sandy fields and small blow-outs in which there is some vegetation are the favourite habitations of *venusta*. This species is sometimes found in company with *Manitoba* in *Manitoba* localities, but *Manitoba* is seldom found in the favourite hunting-ground of *venusta*. *Venusta* is a strong flier, though not quite as strong as *Manitoba*. It is among our most common species, and is found throughout the season. The old brood begins to disappear about the middle of July, and the new appears early in August. The old brood overlaps the new to a small extent. Small open places with a slope facing south are the spots most frequently selected for hibernation; burrows are also found among vegetation on the edges of drifting sand. The average depth of 49 specimens dug out was 19½ inches, the deepest 32 inches and the shallowest 12 inches. In soft sand about 22 inches is the average depth.

I believe the larvæ hibernate at greater depth than the beetles, but exact data are lacking owing to the similarity of some of the species.

Cicindela limbata, Say.—One of the most abundant of our tiger-beetles, abounds on large sandy blow-outs where the vegetation is scanty. It is sometimes found on very small patches of drifting soil, but is always much more plentiful on white sand that is constantly drifting. After high winds they are sometimes found in large numbers in hollows or among grass on the opposite side from which the wind has been blowing. They are found copulating from early in June to quite late in July, often partly buried in the sand. Towards the end of July a great many die off, but some remain in activity until after the new brood has made its appearance during the first and second week of August, specimens of the old brood being at once recognized by the hardness of the elytra, which are also often partly discoloured in old specimens, while in the new they are soft, and make poor cabinet specimens for two weeks or more after they appear, but in this they differ little from other species.

Towards the end of August a few begin to dig out their winter homes, especially on small blow-outs where the ground is dark. By the tenth of September most of the specimens are at work in the above localities, but on white sand they remain tolerably numerous until the last of the month. In 1906 all had disappeared by the 6th of October.

The places chosen for hibernation are at the edges of blow-outs, though, as a rule, in the soft sand. Slopes that are facing the sun at mid-day are much preferred. The holes average 11 inches from the entrance. The deepest measured was 17 inches, and the shallowest 7 inches.

Limbata is one of the first species to make its appearance in the spring. They have been found in sunny spots on the 3rd of April. Doubtless their early appearance is due to the shallowness of their burrows and the warmth of the sand when exposed to the sun.

The larvæ pass the winter in holes of about the same depth as the beetles. They can, however, stand much more cold, and remain active for nearly a month later. In 1906 the last was found digging on the 26th of October, at a time when the ground was frozen to an inch in depth and the temperature was below freezing. A larva dug out on the 24th of October dug to a depth of 4½ inches in 18 hours, with probably large intervals of rest. Larvæ are often found in the middle of blow-outs, though they prefer to dig near grass or weeds.

Cicindela purpurea, sub-sp., *limbalis*, Klug.—In summer inhabits damp ground. The hills of pocket-gophers *(Geomyidæ)* in meadows are favourite haunts. It is also found in company with *repanda* on wet roadways, and with *12-guttata* on the banks of rivers. Copulation takes place in May. This insect is nowhere common, and is nearly always found singly or in pairs. About the middle of September they seek out a somewhat drier spot than their usual summer hunting-ground in which to pass the winter, and they are then found in many odd places. Edges of sandy blow-outs, stubble fields, sand pits, dry roadways and clay banks are among the places where they have been discovered. In sand the depth of hole is about 16 inches, in clay it is 6 inches, and on the edge of roadways where the ground was hard and rooty two specimens were found hibernating only 3 inches below the surface, while in sand the deepest hole was 19 inches.

Limbalis is rather a late form to appear in the spring. The beetles first emerge from pupæ in August.

Cicindela duodecimguttata, Dej.—An abundant species along river banks wherever there is mud or wet sand. They differ from *repanda* in preferring localities close to running streams, often going right to the water's edge in search of food. The form collected at Aweme has much the same markings as *repanda*, excepting that they are narrower and do not extend as much at the margin, some also have the markings broken more like the typical form.

I am indebted to Prof. Wickham for the determination of this species.

The winter homes of *12-guttata* are usually close to their summer ones, being dug into the river banks where there are open spots, from

four to twelve feet from the level of the river. With these species that dig into banks of streams the holes are usually somewhat on the slant. One hundred and forty-eight specimens were dug out, and their holes measured. In sandy soil these averaged 16 inches, deepest 20 inches, shallowest 10 inches. In clay or gravel the average depth was 7 inches, deepest 10 and shallowest 2 inches.

Two or three specimens were often found in the same hole, and 50 or more might be dug out within the space of a square yard. *12-guttata* is the latest of the Aweme tiger-beetles to hibernate, specimens in 1906 being still numerous on the 14th of October, and a few were found quite active, just commencing to excavate burrows, as late as the 20th of October, after heavy frosts.

Larva holes are usually very numerous all up the river banks near where the adults hibernate. The holes generally slant obliquely into the banks. They average in depth from 6 to 15 inches, but in summer time they are often only 4 or 5 inches deep. Both larvæ and imagoes must often perish in their winter homes when the water rises above them.

C. 12-guttata, sub-sp., *repanda*, Dej.—Common along muddy roadways and wet fields. I have found it in abundance along furrows and in wet spots in tall grain, and also on sand in wet localities, and in lesser numbers on rather muddy spots along river banks.

Repanda appears in the spring with *12-guttata*, rather later than the other forms, probably owing to their habit of usually hibernating in cold, damp ground, which takes longer to warm up. The old brood overlaps the new to the extent of about ten days. The new brood begins to appear late in July and during the beginning of August. They are one of the later tigers to hibernate, and owing to their inhabiting wet spots they have often to seek winter quarters some distance away. They have been found hibernating fully half a mile from their summer hunting-grounds, and, no doubt, in some cases go much farther. Hillsides or banks with little vegetation are usually chosen as winter quarters. In sandy localities *repanda* digs to an average depth of 19 inches, the deepest hole examined being 22 inches, shallowest 18. In clay the depth of hole is often only 6 or 8 inches, but when found in company with *12-guttata* their holes average from 2 to 4 inches deeper than that species. Both *12-guttata* and *tranquebarica* have been found in the same hole as *repanda* while hibernating.

Cicindela hirticollis, Say.—A single specimen has been collected at Aweme, which was confused with other species at the time. Unfortunately, no data are available as to habits or time of capture. From its appearance, however, I am convinced that it hibernates. Prof. Wickham says of this species: "Has much the same habits as *repanda*, but is less commonly found in the interior."*

Cicindela tranquebarica, Herbst.—Found on open spots in almost all localities in small numbers. Dry land and wet land, sand, mud or alkali seem to be alike suitable to its tastes. I have found this species hibernating in clay within five feet of the water of a river, and also in dryish sand fully a hundred feet above the water level, with no water in the vicinity. Roadways, stubble fields, muddy flats and pure sand blowouts are where it is found most plentiful, but it is always where the vegetation is very scanty. It has been found in company with all the forms mentioned in this paper, and in the same hole as *12-guttata* and *limbalis* while hibernating. It has also been found hibernating near all the other hibernating kind. The average depth of the winter hole in sandy land is 18 inches, deepest 24 inches, shallowest 11 inches. In clay it averages 8½ inches, deepest 12, shallowest 6 inches.

This species appears from pupa during the middle and latter part of August. In the spring it appears from its winter home with *venusta* as soon as the ground thaws out. It is one of the late species to hibernate.

Ants, small beetles, aphides and cutworms are among its food.

The form found in Manitoba is broadly marked, and has, until recently, been known as *obliquata*.

C. longilabris, aber. *Montana*, Lec.—Black or bronze above, with only a slight indenture to show where the middle band has been. In some this band is partly visible.

Montana inhabits bare spots on dark and dryish land; roadways are seemingly preferred. It has also been taken on ploughed fields, but nowhere plentifully. Unfortunately, I have been unable to secure this form in its winter home, though it undoubtedly hibernates. The new brood makes its appearance towards the end of July and begining of August. This form when disturbed usually flies into the grass, and is then easily captured.

C. obscura, aber. *Lecontei*, Hald.—This form in Manitoba usually has the markings all united so as to form a white margin. The colour varies from bright green to an iridescent-wine colour.

*Habits of American *Cicindelidæ*, p. 220.

Lecontei is found in dry situations. Sandy fields or the edges of drifting sand among sparse vegetation are its favourite spots. It is found in company with *Manitoba*, *venusta* and *tranquebarica*, but nowhere commonly. The new brood appears in August, and they begin to excavate their winter quarters early in September, being one of the first tiger-beetles to disappear. The burrows are nearly always made in very small openings, not more than a foot or so wide, surrounded by weeds, etc., being the least open locality of any of our forms or species, with the possible exception of *Montana*. The average depth of hole of a number measured, from the entrance, was 16 inches, the deepest being 22 inches and shallowest 10 inches. The beetles appear again in the spring in April, at about the same time as *venusta*, and disappear late in July, about a week before the new brood appears. This form has been seen feeding upon cutworms.

C. punctulata, Oliv.—A summer species. Appears late in June and dies off towards the end of August. At Aweme it is found on old trails and on prairie where the grass is thin. Appears to be confined to a few spots, where it is usually plentiful.

The larvæ were found in holes on the prairie in small mossy places between clumps of grass in dry situations, at an average depth of 21 inches, the deepest hole being 26 inches and the shallowest 18 inches. Most of the holes at this date (Oct. 7) were filled up tightly near the top, and again about four inches lower down, so that it was very difficult to push a grass-stalk down them. As with other species, the larvæ greatly exceed the beetles in numbers.

C. pusilla, Say.—This species is taken by Mr. L. E. Marmont, of Rounthwaite, which is only about 12 miles from Aweme. It occurs on roads and bare spots where the land is of a very black colour. Mr. Marmont takes *pusilla* in July and August. One he collected as late as the 24th of August. No sign of the beetles could be found in June, and this fact, combined with the general appearance of the insect, leads me to the conclusion that it is probably a summer species that dies at the approach of winter.

Pusilla has also been taken by Mr. A. W. Hanham at Bird's Hill, near Winnipeg. Mr. Hanham says, from his experience, *pusilla* never flies, but runs very rapidly, "easily disappearing off the trail into the long grass and so away." He adds that he only took two or three at the most. Mr. Marmont on one occasion caught a specimen in a pail of milk.

The species varies in colour from dull green to black. There is also considerable variation in markings, some specimens being almost immaculate.

C. lepida, Dej.—Only found on drifting sand planes, on sand, which they very closely resemble in colour. This is the weakest flier of any Manitoba tiger-beetle that I have collected, and towards the end of their season, at about the time when eggs are being deposited, the females make no attempt to fly, but are obliged to trust entirely to their running powers as a means of escape. They are usually found on the sunny side of a drifting sand-bank, where they get blown by the wind.

Lepida appears late in June, and is most numerous in July. It disappears towards the end of August. I have only once found it at all plentiful.

NOTES AND DESCRIPTIONS OF MEMBRACIDÆ.

BY C. F. BAKER, ESTACION AGRONOMICA; SANTIAGO DE LAS VEGAS, CUBA.

CENTROTIDÆ.

Gerridius abbreviatus, n. sp.

Length, 4.5 mm., male. General form and colour of *G. scutellatus*, but differing widely in the following characters: Legs mostly piceous; the scutellar protuberance directed somewhat forward instead of backward; marks of tegmina arranged in the same pattern, but the oblique band at the middle of tegmina very broad and heavy, being three times as broad at middle of tegmina as at tip of clavus; tegmina with apical margin entirely fuscous, the larger spot at outer tip much broader than long. The most distinctive character lies in the form of the tegmina, which are much shorter than in *G. scutellatus*, the middle apical cell being two-thirds the length of the second discoidal cell, the same cell in *G. scutellatus* not being one-half of second discoidal.

I collected this interesting species at San Marcos, an Indian pueblo well up in the western coast range of Nicaragua.

Ischnocentrus niger, Stal.

The small dark males and the larger paler females (originally described as *I. ferruginosus*, Stal.) I found not uncommon at San Marcos, Grenada, and Chinandega in Nicaragua, these points all being far north of the records given in Biol. Cent. Amer.

SMILIIDÆ.

Cyrtolobus Vanduzei, Godg.

This species was formerly described by Goding under the genus *Smilia*, a genus noted especially for the great elevation of the pronotum

over the lateral angles. But the present species has the form not of *Smilia*, but of *Cyrtolobus*. These two genera cannot be separated by the presence or absence of a cross-vein between the two ulnar veins, since this cross-vein is frequently absent in *Cyrtolobus*, and is commonly present or represented by rudiments in *Smilia;* indeed, numerous specimens in both genera may be found that are *Cyrtolobus* on one side and *Smilia* on the other, and this is a common condition in the species under discussion. However, *Cyrtolobus* rarely has the pronotum at all elevated so far forward as above the lateral angles.

Telamonanthe Rileyi, Godg.

During all the days of collecting I was able to crowd into a busy three years on the West Coast, I was continually looking for the two species of *Telamona* described by Goding as *Rileyi* and *Coquilletii.* Though I collected some *Telamona* related to the *reclivata* of Fitch, still there were no *Telamona* that possessed the characters of these species. I had, however, taken a series of specimens in Middle and Southern California, and received others from Oregon, of a species certainly as variable as any *Telamona*, but belonging in another group of the family. It possessed a petioled apical cell in the wings, and had, besides, the tegminal venation nearly, and also the very strongly produced shoulders of *Antianthe.* Its pronotal hump was more like that of certain *Telamona* than *Antianthe*, not being quite so evenly rounded in front, and rather deeply depressed behind. In two other important particulars it differs widely from *Antianthe:* the radial nervure is distant from the costa and quite close to the outer ulnar, leaving a broad costal area; almost the whole area bounded by the costa and the inner ulnar, except at extreme apex just before the apical areas, is thick coriaceous and strongly punctate throughout.

I had separated this as a new genus and species, and was about to describe it when, through the kindness of Dr. Howard and Mr. Heideman, I was able to study authentic apecimens of Goding's *Telamona Rileyi* and *T. Coquilletii.* In these specimens I found the very species with which I had been working, both representing merely such forms as I possessed a number of within the same species limits, and such as might be found in considerable numbers in almost any eastern species of *Cyrtolobus* and *Telamona.* Goding was evidently misled by the general form and failed to examine the wing venation, or he would never have referred it to *Telamona.* I had named it *Telamonanthe*, and it may bear that name, with *Rileyi* as the type and *Coquilletii* as a synonym.

In the darker forms (the darkest from Oregon) there is a broad brown band with lighter margins, sometimes entirely involving the protuberance, and extending downward and backward to the margin of the pronotum. The anterior extremity of the brown mark, medially, where the protuberance slopes down in front to the level of the pronotum, persists as a characteristic brownish mark even in the palest southern forms, and is present as usual in both of the forms named by Goding.

Micrutalis, sp.

This genus might almost be called the dominant group of the superfamily in Central America and the West Indies, as it is also in the Southern United States. But it is also widely distributed in the United States and Canada. One has only to collect considerable series in any species—say *calva*, which is common in the United States—to discover that like some other membracids (*Telamona* or *Cyrtolobus*, for instance) these species possess a remarkable range of colour variation. Even *Clastoptera proteus* with all its forms is not more protean than some of these species of *Micrutalis*. But I cannot find in the literature that any account has been taken of these marvellous variations, nor have I seen heretofore sufficiently large series in collections to properly illustrate them. Many of the *Micrutalis* "species" of literature have been described from one or a few specimens, whereas but very few of the names represent more than the merest colour forms, as large series clearly prove. For instance, I have now before me from the Southern States, Mexico, Central America and the West Indies, a series of one hundred and seventy-two specimens, which evidently belong to the one specific group, *binaria*, of Fairmaire, some from Belize representing the typical form.

But in the lot there are scarcely two exactly alike, and the gradations extend in various directions. For some of these names can be found, like *mutabilis*, Fowler; *discalis*, Walker; *pallens*, Fowler; *lugubrina*, Stal; *Illinoiensis*, Goding; *apicalis*, Goding; *trifurcata*, Goding; *occidentalis*, Goding; *parva*, Goding; and *binotata*, Goding. All of these are based on the merest colour characters. But we would need twice again as many names to designate the other forms which are equally distinct, and all of which present the same range of form, size and structural characters as the original *binaria*. The relation of this species to *calva*, which appears to be generally larger and longer, and the variability of *calva*, are matters to be investigated by the many collectors living within the range of *calva*. Part, at any rate, of the South American species of Stal are the merest colour forms, and the relation of all of them to *binaria* and more northern

forms must be established by the collection of large series, before a stable nomenclature for the group as a whole can be even suggested. For instance, the *plagiata* of Stal and the *malleifera* of Fowler apparently belong to the same specific group, being very close, structurally. *Malleifera* as it occurs in Nicaragua, Mexico and Belize, is extremely variable. The species of true *Acutalis* are also remarkably variable and equally worthy of collection and investigation.

DARNIDÆ.

Darnoides flavescens, n. sp.

Length, about 4.5 mm. This is a pale yellowish-brown species with an evenly-rounded, not at all raised pronotum, which is evenly, coarsely punctate, and its acute point tipped with black. The sternum is blackened. The tip of pronotum reaches the end of clavus. The tegmina are glassy hyaline, the nervures are pale at base to dark at tip; at extreme base of clavus, and of corium between ulnar vein and costa, the substance of the tegmina is coriaceous and strongly punctate, the puncturing extending outward some distance along the veins. The claval nervure is not half the length of the clavus. The terminal veins are nearly straight except the second from costal margin, which is distally bent towards the costa. There is a single large discoidal cell formed by a cross-vein between inner and outer ulnar veins before the middle of tegmina.

This species was collected in Belize, British Honduras, by a former student of mine, Mr. J. D. Johnston.

Darnoides semicrema, n. sp.

There occurs not uncommonly in the vicinity of Havana, a small membracid which bears a remarkable resemblance to *Acutalis semicrema*, and possibly may be found in some collections under that name. It is, however, shorter and more robust, and differs wholly in its family and genus characters. I cannot find that it has been described. Even if I make a synonym, however, I trust that it will be a readily recognizable one. It is sometimes necessary to make a synonym in order to properly elucidate and bring to light some of the ancient and illy-defined species which would otherwise remain merely stumbling blocks in our literature.

Length, 4.5 mm.; width across pronotum, 2.25 mm. Legs, sternum and abdomen of varying shades of shining piceous, lighter on dorsum and on tibiæ and tarsi. The abdominal segments are narrowly margined with paler. The sternum anteriorly and a large spot on sides of metathorax are more or less white waxy pruinose, the latter spot showing through the costal base of tegmina. The head is very short and broad, the vertex

entirely black to near the front margin of eyes, its surface sparsely and microscopically wrinkled and punctured; the remainder of the head is yellow. The ocelli are slightly farther from each other than from the eyes. The genal margins join the clypeus on either side almost in one straight line. The clypeus extends abruptly, evenly rounded, about as long as wide.

The pronotum on anterior half is black, the posterior half and the sides extending to shoulders are yellow. Over each eye is a large triangular piceous blotch. The pronotum in front is nearly smooth, posteriorly dark punctate. Viewed from the side the upper margin of posterior half is nearly straight, the lower margin between shoulder and tip is trisinuate, the median sinus stronger, and between this and the margin a submarginal pitted groove. The tip of pronotum reaches nearly to end of first inner apical cell.

The claval nervure is more than half the length of clavus. There are three discoidal cells, due to a forking of the outer anteapical nervure and a cross-vein between the two ulnars. The basal cell is small and triangular, and scarcely half the length of the anteapical cell beyond it. The two outer terminal nervures are slightly curved towards the costa. The tegmina are somewhat smoky, the nervures dark distally to nearly colourless at the base. The claval suture and commisural margin are blackened at the extreme base. The corium at base is only punctured along the nervures, while one-fourth of the clavus is coriaceous and punctate. The central apical cell of wings is long and narrow, the sides subparallel and the base truncate.

MOSQUITO NOTES FOR 1906.

It has been customary in the past to speak of mosquito larvæ or wrigglers as dependent on atmospheric air, and to assert that they would drown if shut off from the surface for more than a few minutes. When it was discovered that some wrigglers with well-developed air-tubes were really aquatic, and rarely came to the surface at all until ready to pupate, it was necessary to modify that statement and to admit of numerous exceptions. Yet the statement is still a serviceable one when applied to the more troublesome species, and forms the basis upon which we

recommend oiling stagnant pools to destroy mosquito life. Even where it is generally true, however, mosquito larvæ may, under exceptional conditions, survive complete submergence for some time.

Late in the fall of 1905 (November) Mr. H. H. Brehme was collecting on the salt marshes under instructions to investigate ice-covered pools, and on that day the pools generally had an ice coating one-quarter of an inch or more thick. It was necessary to break through this cover to make collections, and among other things a number of larvæ of *Culex salinarius* were found, apparently dead and lying on the bottom. Put into a bottle of water they sank and remained there for a time. After a few minutes signs of life were observed and feeble movements were noted. Then came a few jerks and a feeble effort to reach the surface. After a short period of quiescence came another attempt, and yet another, until finally the surface was reached, and communication with the outer air was re-established. Again the larvæ descended, remained below a few minutes, reascended, and in about an hour the creatures were as lively as ever. They had been cut off from the air for 12 hours at least, had not been caught in the freezing ice, but had apparently become torpid and sunk to the bottom. With the rise in temperature activity was renewed, and in the laboratory the specimens were nearly all brought to maturity.

November 30, 1906, Mr. Brehme was again collecting on the marshes, and in pools covered with thin ice formed during the preceding night, he took a number of full-grown larvæ and two pupæ of *Culex cantator*. The larvæ were scarce, only two or three to a pool, but all were active and developed normally. It is quite possible, therefore, that in a mild season like that of 1906, a salt-marsh brood might issue as late as December 1st, and, indeed, a communication received from Dr. Howard leads me to believe that locally such a brood did issue in a neighbouring State. If that was also the case in New Jersey it was not noticed, and the insects did not get off the marsh.

We have also been in the habit of considering the adult mosquitoes as rather short-lived, and this turns out to be another error, as to quite a number of species at least. A striking case noticed in 1906 was that of *Culex abfitchii*, which until that year was known from New Jersey by only a specimen or two as the result of three or four years of close collecting. In April of last year the larva was found locally in the Orange Mountains

in great numbers, and in early May the adult was the common woods mosquito, a fierce and persistent biter within its domain, from which it did not venture. Week after week these adults continued on, and not until late July did they decrease materially in numbers. The last captures were August 16, and as all the brood was out of the pools early in May, these specimens had lived well over three months, and the bulk of the brood had lived close to or quite three months. The possibility of a second brood is absolutely excluded, because the local conditions were kept under constant observation during the entire period. We begin to hope that even in 1907 we may yet learn something new concerning these interesting creatures. JOHN B. SMITH, New Brunswick, N. J.

TO COLLECTORS OF NOCTUIDS.

Sir George Hampson is now working at the Acronyctinæ for his "Catalogue of the Lepidoptera Phalenæ in the British Museum." He writes that this group includes all the genera he has not yet dealt with in Dyar's Catalogue down to page 197. He is very badly off for Canadian species, especially from Eastern Canada, in the genera Apatela, Hadena, Papaipema, Caradrina, etc., and large series of as many species as possible will just now be of great assistance to him. I therefore make an appeal to Canadian entomologists to help in this great work, and will gladly receive and forward free of all expense any specimens which Canadian collectors may be willing to send either as donations to the British Museum or as a loan for study. I shall be glad if those having duplicates for exchange in this genus will correspond with me. The above Catalogue is of special use to Lepidopterists of the whole world, and as we now know that Canadian specimens will be acceptable, I have little doubt that many Canadians will help in building up the collections in the British Museum, which is a safe depository for insects, and where every facility for study is given to students from all parts of the world. Good specimens of all Noctuids, particularly from Eastern Canada, will also be acceptable, but at the present time the Acronyctinæ are most desired. Letters and parcels of specimens can be sent to me free of postage if addressed officially.

JAMES FLETCHER, Entomologist and Botanist.
Central Experimental Farm, Ottawa.

NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

(Continued from page 84.)

Hysterosia Merrickana, Kearf.—I desire to limit the type of this species, *ante* page 59, to the specimens from New Brighton, Pa., consisting of four males and two females, the former expanding 24–26 mm. and the latter 26–28 mm. I have two examples from Montclair, which seem to be identical with those from New Brighton, but there is sufficient variation in the specimens from the other localities to warrant separating them, at least for the present, or until longer series or breeding may prove them to be merely local races or distinct species.

Until recently I have identified all of the ochreous-gray and ochreous-brown specimens, having the characteristic dark oblique line from the inner fourth to dorsal margin, and a paler basal area before it, as *H. inopiana*, Haw.; but the accumulation of over one hundred specimens from many different localities makes it possible to separate them into a number of apparently different forms. The following may be added now, and later it may be thought advisable to characterize eight or ten additional forms which seem to be different:

Hysterosia komonana, sp. nov.

Head and palpi grayish-white, latter lightly shaded with brown outside, antenna gray, basal joint ochreous brown; thorax whitish-fawn; abdomen light yellowish-gray, segments 6 and 7 light fuscous, anal tuft whitish-fawn; legs whitish-fawn, dusted and banded with bronzy-brown.

Fore wing: Fold brown; an ochreous-brown shade from inner fifth of dorsum turns under costa at middle, without reaching it; before this shade the basal area is whitish-fawn; beyond the shade the whitish-fawn ground colour is strigulated with light brown. A darker dot at end of cell in middle of wing. The dark strigulations are somewhat closer together in apical end of wing, but not sufficient to form the dark apical patch that is so characteristic of this genus. Cilia concolorous, but shining.

Hind wing yellowish-gray, reticulated with light brown, cilia paler, with a darker line near base; under side the same. Under side fore wing light ochreous-brown.

Expanse, 22–26 mm.

Nine specimens: Alma, Santa Clara Co., California, J. G. Grundel; Stockton, Utah, Tom Spalding.

Hysterosia waracana, sp. nov.

Head, palpi and thorax cream-fawn, palpi darker on outside; antenna leaden-brown; abdomen yellowish-white, fuscous on two segments before anal segment, with whitish lateral tufts, anal tuft ochreous; legs whitish, dusted and banded with brown.

Fore wing very pale yellowish-fawn, with only a suggestion of a paler oblique basal line. Cilia the same.

Hind wing purplish-gray, not strigulated, cilia white, divided near base by a fuscous darker line; under side the same, but very faintly strigulated. Under side fore wing ochreous with a purplish tinge, lighter along costa.

The females are darker than the males, fore wing ochreous-fawn; hind wing darker purplish-gray.

Expanse, 15–19 mm.

Two male and six female specimens: Regina, Assa., July 15, collected by Dr. James Fletcher; Prince Albert, T. N. Willing.

Hysterosia riscana, sp. nov.

Head light yellowish-brown; palpi cream-white inside and upper edge, fuscous brown outside and outer ends; antenna yellowish-gray; thorax light yellowish-brown, sides of tuft fuscous-brown, posterior end of tuft whitish; abdomen grayish-fuscous, anal tuft pale ochreous; legs ochreous-white, dusted and banded with dark fuscous-brown.

Fore wing gray, heavily irrorated with bronzy-black. There is an oblique narrow white streak from dorsum near base to upper end of cell, about inner third; before this streak the dark scales are lessened, causing a gray shade, beyond it they are increased, resulting in a darker shade. The apical area, from outer fourth of costa to anal angle, is darker than the rest of wing; before it is a narrow fascia paler than the area before it; this fascia broadens out on dorsal margin, with a spot of whitish scales on anal angle, with a few black dots on its outer edge. Cilia bronzy-gray.

Hind wing bronzy-gray, strigulated with darker vertical lines, cilia whitish-gray, with a narrow light basal line, beyond which is a broader dark line; under side very light brownish-white, with strigulations much stronger than upper side. Under side fore wing smoky-bronzy fuscous, paler on costa, with a dark spot at end of each vein, the one at vein 10 the largest and darkest.

Expanse, 14–19 mm.

Three specimens: Essex Co., Park, New Jersey, Light Trap, July 2; Glenburn, Pa., July 10 and 20, A. E. Lister.

This is allied to *H. Merrickana*, K. It can be separated by the edge defining the dark apical area, which in *Merrickana* is straight, and in *riscana* at upper third turns, goes to costa vertically, making a hump at that point.

Hysterosia tiscana, sp. nov.

Expanse, ♂ 15–18 mm, ♀ 17–19 mm.

Head grayish-ochreous; palpi grayish-white inside, bronzy-black outside; antenna brownish-fuscous, middle of thorax and patagia bright ochreous-brown, edged on side with blackish-brown, the posterior tips of the scales whitish; abdomen grayish-fuscous, anal tuft cinereous; legs whitish, banded and dusted with bronzy-black.

Fore wing mottled shades of gray, fuscous and bronzy-black. The oblique line from dorsum at inner fourth is almost obsolete, being a more intense blackish shade on the dark ground colour; it is, however, sharply outlined on basal side by streak of whitish, mixed with a few ochreous scales. There are three black lines in the apical fourth, beginning on costa and coming nearly together at tornus. These lines are edged with ochreous, and vertical ochreous strigulæ cross the wing, especially on the lower half, between these lines and the base. At the end of cell is an angulated cluster of black scales, margined with white, and between it and the inner of the three black lines is a parallel short black line in middle of wing. Between the middle black line and termen the ground colour is whitish-gray. Terminal line black, cut by three dashes from as many small white spots in tornus. Cilia gray.

Hind wing pale gray, cilia the same, with a darker basal line; under side gray, heavily reticulated with bronzy-brown. Under side fore wing smoky-black, spotted with dull ochreous on costa, terminal line black, preceded by a dull ochreous line. The females are much darker, thorax and fore wing almost uniform bronzy-black, without any paler markings.

Five males and four females, Essex County Park, N. J., Aug 1–22; Light trap.

Hysterosia Cartwrightana, sp. nov.

Expanse, 18–24 mm.

Head and thorax light brownish-ochreous; palpi whitish inside, light brownish-ochreous outside, shaded anteriorly with bronzy-brown; antenna brownish-fuscous; abdomen ochreous-fuscous; legs whitish, banded and dusted with bronzy-black.

Fore wing light ochreous-brown, shaded with yellowish-fawn below the fold, and with grayish on the outer half of wing. The dark shades and line are bronzy-black. The dorsal oblique shade from inner fourth is distinct, and ends in a horizontal dark dash in middle of cell. The basal shade before it is whitish. Beyond the middle the costa is marked with four dull ochreous spots and a fifth in apex; from between each of these irregular lines of blackish scales cross the wing. From the end of the cell a dark shade extends to the termen, beginning as a point in the middle of wing, and increasing in width until at termen it extends from apex nearly to dorsum. The space above and below it is by contrast paler. Cilia ochreous-gray, cut between each two veins by a lighter streak.

Hind wing grayish-white to fuscous-gray, cilia paler, preceded by a darker line; under side ochreous-gray, heavily reticulated with dark brown. Under side fore wing smoky-brown, costa dotted with dull ochreous.

Six specimens, Cartwright, Manitoba, E. Firmstone Heath.

Hysterosia Pecosana, sp. nov.

Expanse, 20–25 mm.

Head and palpi ochreous-brown, latter paler inside; antenna grayish-fuscous; abdomen ochreous-brown, anal tuft whitish; legs whitish, banded with bronzy-black.

Fore wing almost uniformly light ochreous-brown. There is a whitish shade before the dark oblique shade from inner fourth of dorsum; the dark shade is only conspicuous at its upper end, where it forms a dark spot in the middle of the wing; there is a similar dark brown spot at end of cell; beyond which are some dark vertical strigulations. Cilia whitish-ochreous.

Hind wing ochreous-gray, cilia paler, with a darker basal line; under side the same, very faintly strigulated with a darker shade. Under side fore wing smoky-brown.

Three specimens, South-west Colorado, July 26, W. G. Dietz; Beulah, New Mexico, July, Cockerell; Pecos, New Mexico, at light, Aug. 16, Cockerell.

The description is from the Colorado specimen. The one from New Mexico is more distinctly marked on costa with blackish dots, and below fold with blackish strigulations.

Carposina Ottawana, sp. nov.

Expanse, 16–17 mm.

Head dark gray, whitish in front; palpi whitish inside, ochreous, dotted with bronzy-brown outside; antenna bronzy-gray; thorax bronzy-gray, posterior end whitish-gray; abdomen dark shining fuscous above, anal tuft dull ochreous; legs whitish, dusted and banded with bronzy-brown.

Fore wing shades of gray and fuscous. There is a whitish-gray basal patch, extending in middle of wing to inner third, with a small bronzy-brown spot on dorsum at base, and another above it in middle of wing extending to costa. The costal edge is slightly darker gray, and is marked with six large bronzy-brown spots between inner third and apex. At the end of cell there are two spots, vertical to each other, of dark brown raised scales, shaded with whitish outwardly. In the fold beyond middle of wing is a short blackish line, above which is a cluster of grayish raised scales, edged outwardly with white. Below the fold, on inner third, is a small blackish dot. There are a few black dots on the outer fourth of wing, below the costal spots, and an irregular line of black dots before termen. Cilia dark, speckled gray.

Hind wing smoky-gray, cilia same but shining; under side paler. Under side fore wing dark smoky gray.

One ♂ and two ♀ specimens, Ottawa, Canada, June 20, C. H. Young.

The fore wings of this species are narrow, but less pointed than *crescentella*, Wlsm.; it resembles *crescentella*, but is generally darker, and the crescent-shaped row of black spots with the white character before them are entirely wanting.

Proteopteryx momonana, sp. nov.

Expanse, 13.5–15 mm.

Head ochreous-gray; palpi cinereous brown outside and in front, inside dirty white; antenna ochreous-brown; thorax grayish-brown; patagia ochreous-brown; abdomen fuscous above, silvery-white below and on sides; legs whitish, dusted and banded with dark brown.

Fore wing dark bronzy-brown, somewhat overlaid with grayish-blue on the inner half, shading into ochreous-brown in the outer half; the ochreous shade is brighter in the apex. There is a conspicuous pure white dorsal spot, between middle and outer fourth; the inner edge is slightly oblique and convex (the dark ground colour is more intense where it touches this spot); it extends to middle of wing, and is slightly angulated at the top; the outer edge is angulated and outwardly oblique; it sends a

spur towards the ocellic apot, and with the ocellic spot encloses a blackish-brown elongated dorsal spot; the latter contains a few whitish scales on dorsum, and the white spot is similarly marked with brown dots. The ocellus is large, the centre is ochreous, crossed by four short black lines; below it is gray, and the vertical side bars are shining gray; at the upper end of the inner bar a gray prominence points toward the outer end of the white dorsal spot. Costa is marked with four black dots, between middle and apex, each outlined by whitish ochreous lines; below costa these lines are leaden-metallic, and proceed horizontally below costa towards termen. Below apex the black terminal line is cut by a white dash, and a similar interruption occurs at the tornus. Cilia leaden-cinereous.

Hind wing whitish-gray at base, shaded with smoky-black outwardly; cilia light gray, with a black basal line; under side grayish-white. Under side fore wing smoky-brown, costal spots repeated.

Eight ♀ specimens, Ottawa, Canada, July 6 to Aug. 8, C. H. Young; Rounthwaite, Manitoba, July, L. E. Marmont.

Fore wing: termen concave between veins 3 and 7, all veins free. Hind wing: 3 and 4 short-stalked, 5 close to base of 4.

Epinotia fortunana, sp. nov.

Expanse, 13–17 mm.

Head whitish-ochreous, face paler; palpi cream-white inside, anterior end and outside darker; antenna pale fawn; thorax dark brown in middle, edged with pale fawn; abdomen dark fuscous; legs cream-white, banded with bronzy-brown.

Fore wing cream-white, with basal area, fascia and spots of black overlaid with ochreous scales. The basal area extends beyond inner fourth on costa, is obliquely outward to middle of wing, then angles slightly inward to dorsum, which it reaches beyond inner third; it contains a streak of cream-white on its inner half on the dorsal margin, which at the outer end sends a white shade above middle of wing; the outer edge touches margin of basal area below the costa, the upper edge of this shade connects with two whitish costal spots; the dark spots, outlined by these white streaks, are ochreous in the middle and outlined with black. There is a cream-white, narrow, angulated fascia in middle of wing, divided by a line of shining pale ochreous. Where the fascia touches costa it is divided by a blackish-brown dash. Beyond the fascia are four large geminate whitish costal spots; the second one is the beginning of an outer angulated fascia, which sends a spur to tornus, and above middle an

inward streak, which connects with a similar outer spur from the middle fascia. The outer costal spot sends a white streak into termen below apex; and just below it a whitish line starts, which parallels termen and connects at the tornus with the spur from the outer fascia. The spots between these whitish bands are black, dusted with ochreous. Terminal line black, cut below apex and in tornus, where the white bands touch these points. Cilia mottled leaden-gray, paler at base.

Hind wing smoky-brown, cilia dark gray, with a darker basal line; under side gray. Under side fore wing dark smoky-brown, costal spots repeated.

Twelve specimens, Ottawa, Canada, June 24 to July 3, C. H. Young.

Enarmonia Fletcherana, sp. nov.

Expanse, 13–15 mm.

Head, palpi and antenna cream-white; thorax cream-white, smooth and shining, with an iridescent reflection; abdomen shining fuscous above, cream-white below; legs cream-white, the anterior pair lightly banded with light brown in front.

Fore wing: Inner half of wing, including basal area, cream-white; the basal area is defined by a broken angulated line of black, starting as a short, outwardly oblique dash from inner fifth of costa to upper edge of cell; in middle of cell, about one-third from base, the line begins again, and continues obliquely to inner fourth of dorsum. In the white area the costa is marked with two or three dark dots, and as many on dorsum beyond the dark line. The white area extends to inner two-fifths on costa and to outer third on dorsum; beyond it the outer half of wing is black, thickly mottled with metallic-blue scales. While the division is sharply marked, the edges of the white and dark areas are irregular. In the black area, at the end of cell, is a large patch of blue-metallic scales, some of which edge the white area; there are a few whitish scales in this patch, and through its middle it sends a black line into the white area. The terminal line is black, preceded by an olivaceous-ochreous shade, and the same shade continues below costa, in the dark area, on which are three blackish-brown spots, edged with pale ochreous on inner, the larger spot on costa, marks the beginning of the dark area. From the pale ochreous costal lines the metallic-blue lines begin below the costa, where they touch the termen; they cut the black terminal line with pale ochreous dashes, one below apex, one above tornus, and one in tornus; these ochreous terminal dashes are of the same value as the costal ochreous dashes. All of the

large ocellic area is overlaid with lines of metallic-blue. Cilia grayish-fuscous, shading into pale-ochreous at base and around tornus.

Hind wing light smoky-brown, paler toward base, cilia pale ochreous, preceded by a dark basal line; under side darker, mottled along costa. Under side fore wing dark smoky-brown, costal spots repeated.

Nine specimens, Ottawa, Canada, June 18 to July 3, C. H. Young.

I take a great deal of pleasure in dedicating this most beautiful and distinctive species to my very good friend, Dr. James Fletcher.

Enarmonia prosperana, sp. nov.

Expanse, 13–17 mm.

Head smoky-fuscous; palpi white inside, fuscous outside, apical joint dark fuscous; antenna and thorax dark fuscous; abdomen shining whitish-fuscous, anal tuft dull ochreous; legs whitish, banded and dusted with bronzy-black.

Fore wing: Inner three-fifths cream white, suffused on the basal half with broad grayish-fuscous strigulæ, becoming paler outwardly, and disappearing before the termination of the white area, and having an angulated white band in the middle of wing; the costa in this area is fuscous, marked with four or five white dashes. The outer third of wing is fuscous, mottled with lighter scales; it encloses a large ocellic spot of three horizontal black lines, and vertical inner and outer bars of metallic blue; a few metallic dots of the same colour nearly join the lower ends of the bars; between and below these dots are black dots, and a broken line of black is in the basal side of the inner bar, with a short line of black before it, in the edge of the white fascia. The outer half of costa is ochreous-fuscous, and marked with four large geminate white oblique lines, each sending below a line of metallic-blue; that from the inner joins the inner ocellic bar: the metallic lines from the second and fourth geminate dashes join and go into termen below apex, where they interrupt the black terminal line. There is a dot or small cluster of black scales between fold and middle of wing, about two-fifths from base; there are a few black dots below the costa. Cilia leaden-metallic.

Hind wing smoky-brown, paler at base; cilia white, with a darker line close to base, and a finer line between it and outer ends; under side darker and blotched with bronzy-brown, especially below costa on outer half. Under side fore wing bronzy-black, with a grayish reflection, costal spots repeated.

Fifty or more specimens, Wellington, B. C., Taylor and Bryant; Vernon, B. C., Venables; San Luis Obispo, Vachell; etc., etc.

This species is close to *succedana*, Schif., of Europe.

(To be continued.)

MOSQUITO NOTES.—No. 5.—Continued.

BY C. S. LUDLOW, M. SC.,
Laboratory of the Office of the Surgeon-General, U. S. Army, Washington, D. C.

In the article describing *Grabhamia nigromaculis** mihi, reference was made to a group of mosquitoes in the north-western part of the U. S., and probably occurring also in Canada, in which the species are closely related and the individuals show great variation, and to which *nigromaculis* belonged. Two more of this group are described below, one of which lies close to *G. Curriei*, Coq., but the distinct, clean-cut abdominal markings and difference in colouring are characteristic; though corresponding to the habit of the group, there is variation among the individuals.

Grabhamia mediolineata, n. sp.—(Female.)

Head dark brown or black, covered with long, curved, pale, almost white scales, a few ochraceous ones; bright brown flat lateral, and slender white forked scales on the occiput, some brown bristles between the eyes and around the eyes; antennæ dark brown, verticels dark brown, pubescence white, first joint testaceous, and in some lights all the joints are apparently light banded, basal joint testaceous, with slender flat white scales on the median surface; palpi black, a few white scales at the tip, and occasionally at the base of penultimate joint; proboscis black and quite long, tip black; clypeus black; eyes black and silver.

Thorax black, prothoracic lobes with long pale ochraceous curved scales (spatulate?); mesonotum covered on the median third with bright brown slender curved scales for about two-thirds its length, the caudad third with slender pale curved scales; immediately laterad of this median stripe is a broad pale stripe of rather broader curved scales, and exterior to this another stripe of brown curved scales extending to the wing joint; scutellum black, covered with long slender curved scales; pleura black, with long white spatulate scales; metanotum black.

Abdomen black, covered with black and white or "dirty-white" scales, so arranged as to make a slender median light line, transverse white bands mostly basal, but involving both segments, and on the more caudad segments are almost entirely apical, the distal segments being in some cases mostly white; white lateral spots, which are really extensions of the

*A new American mosquito.
The University Bulletin, The George Washington Univ., Washington, D. C., Jan., 1907.

white scaling of the venter, and on most of the segments extend the whole length.

Legs: coxæ and trochanters light, and white-scaled; femora white ventrally, speckled black and white dorsally, a narrow black ring just proximal to the tiny white knee spot; fore and mid tibiæ white ventrally (on the hind legs this is reduced to a white line), speckled dorsally, a little darker near the apex, but the apex light, and in the hind legs there is a distinct dark band and light apex as on the femora; metatarsi speckled, those of the fore legs having light apices, of the hind legs having both slightly lighter bases and light apices. On the fore legs the first tarsal joints are black, with basal light bands, all the other joints dark; on the mid leg the first and second joints are still a little speckled, and have white basal bands and tiny white apical spots, sometimes unbanded, third and fourth joints dark; on the hind legs the first and second joints are dark (black), with basal and apical light bands, the third has a basal light band, and the fourth is light; all ungues equal and uniserrate.

Wings clear, speckled with black and white scales, the costa being mostly black, and the sixth long vein white, first submarginal a little longer and more narrow than the second posterior cell, the petiole in each case about half as long as the cell; mid cross-vein twice as long as the "supernumerary," and equal to the posterior cross-vein, which is about its own length distant; halteres, light stem and dark knobs.

The leg banding involves both sides of most of the joints, and in this greatly resembles *G. Curriei*, the thoracic marking suggests *G. lativitatta*, but the abdominal marking is clear, in some cases being only clean-cut lines, in others a little ragged. The types do not, however, suggest either species more than to indicate their close relationship, having a peculiarly tidy appearance which the others lack.

Length, 7.5 mm.

Habitat, Fort Lincoln, N. D. Taken June, July, August.

Grabhamia grisea, n. sp.—(Female.)

Head dark, covered with slender curved scales, light ochraceous on the occiput, a triangular space of darker golden brown, scales just external, and ochraceous flat scales on the sides, no fork scales; antennæ brown, verticels brown, pubescence light, basal joint brown, covered with flat ochraceous scales; palpi entirely brown scaled; proboscis brown, a light band, narrow on the dorsal and wider on the ventral aspect, at the apex of the proximal half; clypeus brown; eyes brown and gold.

Thorax dark brown, prothoracic lobes with slender curved light brown scales; mesonotum with slender curved scales, a distinct bare (dark) median line, immediately laterad of which on either side is a broad stripe of bright brown scales, then a light golden brown or ochraceous stripe extending cephalad from the scutellum to nape, external to these on the caudad half are the darker brown scales, and the lateral portion of the dorsum is covered with the lighter brown scales; scutellum dark, with light brown or ochraceous scales, and long light bristles on the margin; pleura ashy-brown, with white scales; metanotum dark brown.

Abdomen dark, heavily and closely covered by flat ochraceous scales; two tiny dark submedian points not large enough to call spots, and yet very distinct, on all the segments but the first, which has a large bunch of almost white scales and light hairs; ventrally the abdomen is also covered with ochraceous scales, but not so heavily as dorsally.

Legs: coxæ and trochanters mostly light-scaled; femora dorsally sprinkled with dark brown and ochraceous scales, darker toward the apex, but the very apex white; ventrad, caudad and cephalad aspects ochraceous. Tibiæ much like femora but darker, and on the hind legs have a distinct dark apical band; metatarsi on fore legs much like tibiæ, and all the following joints missing; on mid legs also much like tibiæ; tarsal joints dark, the first and second with small ochraceous basal spots; on the hind legs the metatarsi are quite dark but still slightly sprinkled with light scales, and it and all the tarsal joints except the fourth are heavily basally white-banded, the fourth dark; all ungues uniserrate.

Wings clear, mostly dark-scaled, especially near the costa, the sixth long vein mostly dark, first submarginal a little longer and about half the width of the second posterior cell, the stems in each case about two-thirds the length of the cell; cross-veins nearly equal in length, the posterior about its own length distant from the mid; halteres mostly light, a little darkened on the knobs.

Length, 5–6 mm.

Habitat, Boise Barracks, Idaho. Taken July.

This evidently lies near *G. Fletcherii*, but the abdominal marking is distinct, and the specimens of *Fletcherii* which I have seen do not show a marked band on the hind metatarsi, nor a white band on the proboscis.

Both species were collected by the Surgeon U. S. Army, on duty at the respective places, but in one case the name was not sent in.

NOTE ON EUCHŒCA PERLINEATA, PACKARD.

BY GEO. W. TAYLOR, WELLINGTON, B. C.

In February of last year Mr. Pearsall described as a new species, under the name *Euchœca exhumata*, a moth standing in nearly all collections as *E. perlineata*, Packard; and he is now,* in order to justify his action, endeavouring to show that the original *perlineata* of Packard was not what we all supposed it to be, but something quite different.

In the course of his researches he has found two specimens in the late Dr. Lintner's collection, labelled *Larentia perlineata*.

If these are really Packard's original types, as Mr. Pearsall assumes, and as, for the sake of argument, I am ready to admit; and if, further, they are really specimens of *Euchœca comptaria*, Walker, as Mr. Pearsall asserts, and as is quite possibly the case, and for the sake of argument I will admit this too—though I think that in the face of the original description and original figures of *perlineata*, and of the universal usage to which I have before called attention, and in view, further, of the fact that Mr. Pearsall has admittedly made some mistakes in his determinations in this genus, I might be justified in hesitating to accept his dictum in these points—what then?

It merely shows us that Packard had a very confused idea of his own species; that he had indeed two species mixed, which is quite probable, and that while he figured one form, which had not previously been made known to science, and, as I believe, wrote his description from the same form, he placed his type labels on another quite distinct form (almost indistinguishable from a species of his own which he had described at the same time and on the same page) which had previously received the name *Tephrosia ? comptaria* from Walker.

Under these circumstances, possibly Mr. Pearsall would be justified in giving the figured species a new name as he has done, but for my part I think it would be fairer to Packard, and much more convenient to students, to allow the old name to stand.

I really cannot acknowledge the propriety or see the advantage of changing a well-known name backed up by a capital description and two unmistakable figures, and, I repeat once more, by a usage of 30 years, just because there is a possibility that two ancient specimens in a certain collection may have been the original types, and may have been correctly determined by Mr. Pearsall as specimens of another species. I shall,

*Canadian Entomologist, XXXVIII, p. 36.

therefore, without, however, any desire to dictate to those who prefer to take a different view, continue to write :

Euchœca perlineata, Packard.
= exhumata, Pearsall.

There are other points in Mr. Pearsall's article upon which one might comment, but I am very reluctant to take up further space in discussing a question of which the readers of the CANADIAN ENTOMOLOGIST must by this time be very tired.

NEW HYMENOPTEROUS PARASITES OF ANTHONOMUS GRANDIS, BOH.

BY J. C. CRAWFORD, U. S. DEPARTMENT OF AGRICULTURE.

Torymus anthonomi, n. sp.—♀. Dull greenish, showing purplish tinges, especially on abdomen; head and thorax with abundant whitish pubescence, finely, closely punctured, the prothorax rather indistinctly transversely aciculated ; temples narrow, making the head very narrow anterio-posteriorly; cheeks, from eyes to base of mandibles, carinate; scape light reddish, flagellum dark; femora aeneous, tibiæ light reddish-testaceous, tarsi whitish, apically dark ; metathorax almost perpendicularly declivous, basally with short longitudinal rugæ, the centre ones longer, median one reaching almost to insertion of abdomen, rest of surface finely shagreened; metathoracic spiracles long oval ; wings hyaline, stigmal vein two-thirds the length of postmarginal; marginal twice as long as postmarginal; abdomen very finely transversely lineated.

Length, 3 mm.; ovipositor, 1½ mm.

♂.—Differs from ♀ only in the usual sexual characters and in size. Length, 1.75 mm.

Type locality, Waco, Tex., Aug. 29, 1906; also from Hallettsville, Tex., Aug. 9 and 30, 1906, 2 ♀. From Mexia, Tex., 1 ♀, Sept. 29, 1905, bred from *Brachytarsus* in heads of *Sideranthus rubiginosus*.

Type number 10040, U. S. Nat. Mus.

Urosigalphus anthonomi, n. sp.—♀. Black, shiny ; legs red, thinly clothed with inconspicuous white hairs ; antennæ and mandibles reddish, the antennæ 14-jointed, reaching to base of abdomen ; antennal grooves very short ; between antennæ the grooves distinctly carinated at edge, the outer edges not with distinct carinæ ; inter-ocellar area elevated to a truncate pyramid, the ocelli at the bases of the sides, face with strong close punctures, behind ocelli coarse ; median area of mesonotum rugose, not

so coarse anteriorly, lateral areas finely punctured ; scutellum elevated, rugose, posteriorly a narrow, smooth shining border ; truncation of metathorax rounded by a strong salient rim, elevated at centre dorsally, surface of truncature coarsely punctured ; base of metathorax with a few strong longitudinal rugæ and a median longitudinal carina joining the median elevation of salient rim ; abdomen somewhat reddish toward base, rugose with coarse punctures, the intervening elevations forming longitudinal lines, especially in basal half ; apex of abdomen with two long sharp spines, ovipositor hardly as long as the abdomen.

Length, 3½ mm.

Brownsville, Texas, Aug. 19, 1895, C. H. T. Townsend coll.

♂.—Similar, the antennæ longer, 14-jointed; no reddish on abdomen, carina of antennal grooves more distinct. Length, 3½ mm.

Brownsville, Texas, bred Sept. 20, 1906, W. D. Pierce.

Type number 10041, U. S. Nat. Mus.

Urosigalphus Schwarzi, n. sp.—♀. Black, shining, legs red, the hind tibiæ and tarsi reddish-fuscous, head and thorax covered with abundant short white pubescence ; face finely, rather closely punctured ; antennæ dark, 14-jointed, obscurely reddish, reaching to base of metathorax; antennal grooves deep, reaching to posterior ocelli ; a narrow shallow depression from centre of front to insertion of antennæ, broadening upwardly, the edges of upper part subcarinate ; above insertion of antennæ these carinæ become the carinæ of the inner edges of antennal grooves ; mesothorax except lateral areas coarsely rugoso-punctate; lateral areas medially smooth, very shiny, finely sparsely punctured, scutellum elevated, postscutellum with a small median V-shaped elevation, the point caudad ; truncation of metathorax coarsely punctured, the surrounding carinæ elevated at dorsal centre ; wings slightly dusky, costa and stigma very dark, rest of nervures brown ; radius obsolete beyond basal third of marginal cell; abdomen coarsely, closely punctured, basally the intervening surface forming distinct longitudinal ridges, apex of abdomen with two short blunt spines ; ovipositor about as long as abdomen. Length, 3 mm.

♂.—Similar to ♀ except in sexual characters ; antennæ reaching one-third of distance to tip of abdomen, 14-jointed. Length, 3 mm.

Five females, one male, Cacao, Trece Aguas, Alta Vera Paz, Guatemala, E. A. Schwarz and H. S. Barber coll.

Type number 10042, U. S. Nat. Mus.

NEW ANTHIDIINE BEES FROM COLORADO.

BY T. D. A. COCKERELL, BOULDER, COLO.

Anthidium tenuifloræ, n. sp.

♀. Length about 10 mm.; black, with pale pubescence, that on head and thorax above faintly yellowish; ventral scopa sepia-brown, except at the sides, where it is pale; head with no pale markings, except a round cream-coloured spot above summit of each eye; mandibles 6-dentate, the third to fifth teeth smallest; lower edge of clypeus crenulate, with a tooth on each side, followed by a smaller one; clypeus very densely punctured; scape all dark; thorax without light markings; tegulæ cream-coloured in front, and with a small light spot behind; legs black, tibiæ with a light spot at extreme base, and hind tibiæ with more or less of a streak at apex; hair on inner side of hind tarsi coppery-red; abdominal bands cream-colour, slightly interrupted in the middle, and broadly emarginate above laterally.

♂. About the same size; clypeus, lateral marks (extending a little above clypeus), and most of outer surface of mandibles, as well as a stripe on scape, cream-colour; stripe on middle of anterior tibiæ and outer side of basal joint of all the tarsi cream-colour; tubercles and scutellum wholly dark; lateral apical lobes of abdomen broadly rounded, not curved inwards or pointed, their breadth about equal to the space between them and the central spine.

Hab.—Boulder, Colo. *(W. P. Cockerell)*; 1 ♂ June 12, 1905; 1 ♀ same date; 1 ♀ Aug. 8, 1906, at flowers of *Psoralea tenuiflora*, Pursh.

I had confused this with *A. emarginatum*, Say, to which it is very closely allied; but it is easily distinguished by the colour of the scopa in the ♀, and the dark tubercles and scutellum in the ♂. The general structure, venation, etc., agree with *emarginatum*. The real *A. emarginatum* occurs at Ward, Colorado.

Anthidium porteræ personulatum, n. sub-sp.

♀. Clypeus entirely black; lateral face-marks small, oblong, not nearly filling space between clypeus and eye; lateral marks on mesothorax rudimentary.

♂. Ground colour of abdomen quite black; apical lobes and spine entirely black; yellow marks on scutellum smaller.

Hab.—Boulder, Colo. *(W. P. Cockerell)*; both sexes at flowers of *Psoralea tenuiflora*, Pursh., Aug. 8, 1906.

The geniune *A. porteræ*, Ckll., is common at Boulder, visiting *Psoralea tenuiflora* and *Grindelia*. The males mostly have the abdomen very red (var. *amabile*, Ckll.), but the females do not show this variation,

Dianthidium Sayi, n. n.

This is the *Megachile interrupta*, Say, 1824; *Anthidium interruptum* (Say), Sm., but not *A. interruptum*, Fabricius, of much earlier date.* It has been referred in recent years to *A. curvatum*, Smith, but that is a species from Georgia, with the legs mainly yellow, whereas in *Sayi* they are red in both sexes. *D. Sayi* is not uncommon in Colorado. I have before me specimens from Trinidad, Colo., July 13, 1899 (*Titus*), and Boulder, the male, Aug. 7, 1906, at flowers of *Grindelia*; the female Aug. 8, 1906, at flowers of *Helianthus lenticularis* (both coll. *W. P. Cockerell*).

In my original account of *Dianthidium* I cited *D. curvatum* as the type; *curvatum*, Auctt. (not Smith) = *Sayi*, was intended.

At Mesilla, New Mexico, Aug. 23, I took a female representing a new sub-species, *D. Sayi xerophilum*, in which the ferruginous colour has overspread practically all of the head and thorax, except the disc of mesothorax, and the abdomen above is bright yellow with narrow ferruginous bands, the basin of the first segment and most of the apical segment also ferruginous. There is a wedged-shaped black area below each antenna, and laterad of this a yellow suffusion. The legs are entirely red.

A NOTE ON GENERIC TRANSFERS.

In the December CANADIAN ENTOMOLOGIST, p. 415, Mr. Pearsall gives convincing reasons why the species of *Tallegeda* should be referred to *Philopsia*, but he does not provide the resulting names: *Philopsia montanata* (Packard) and *Philopsia tabulata* (Hulst). Similarly in the December *Entomological News*, p. 370, *Stilpon Houghii* is said to belong to *Chersodromia*, but the name *Chersodromia Houghii* (Mel.), is not written. Entomologists are so busy with other matters that it never occurs to them, in the majority of cases, to pay attention to little details of this sort; yet, when we have adopted more exact bibliographical methods, following the lead of the ornithologists and botanists, these omissions will be found to occasion a good deal of inconvenience. Thus, the first citation of a particular binomial will often have to be from some incidental mention, instead of from the place where the reason for the transfer is given. I cannot doubt that entomologists generally will see the advantage of the precise methods advocated if they consider them a little. Of course, if the number of species involved is large, the transfer of a few of the best known will give the appropriate clue to the user of a bibliography.

Incidentally, I may suggest that Dr. Williston (CAN. ENT., Dec, p. 388) should have hesitated to print the names Stomoxiidæ, etc., even as awful examples, remembering Dr. Palmer's solemn treatment of a similar venture of Rafinesque's, in his recent index to the Genera of Mammals!

T. D. A. COCKERELL.

*Nor *Megachile interrupta*, Spinola, 1806.

NEW HISTORIES IN PAPAIPEMA (HYDROECIA).

BY HENRY BIRD, RYE, N. Y.

(Continued from Vol. XXXV, p. 94.)

Just how far patient endeavours may go unrewarded without a complete despair attending, is often well brought out in entomological studies. The quest of such boring larvæ as the Noctuid genus *Papaipema* possess, gives us a good trial oftentimes, since their hidden whereabouts within some unexpected root or stem frequently leads one a merry chase indeed. Knowing, however, that a certain species has been apprehended in the moth state at a given locality, in the not too remote past, there is a reasonable assurance that somewhere here, in some unknown food-plant or underground root, there lurks the desired larva, no doubt in the goodly company of many others of its kind. To know this food-plant and to learn this habit are the questions which confront the seeker in Gortynid lore, and it is surprising how long we may look, and, for a fact, overlook such a species, the while a most critical search goes on for its apprehension. Many years since an imago of *Papaipema circumlucens* was taken at Rye, and for the last decade an unremitting search has been made for a discovery of its larva. But fortune smiles at last, though the final meeting is so unexpected and commonplace withal, that it savours more of carelessness than of success.

A slight resume touching this species may now be admissible, since the literature has but few references to it. Prof. J. B. Smith, in a revision of the genus (1897), first accords to it specific rank. The few examples in collections at that time, together with several other species, stood in an aggregation under the *rutila* label. His differentiation is based on well-detected grounds, and the larva, now that it has come to light, aids still further the individuality. A few other citations of catalogue or locality reference are all else that pertain to the species.

The imago shows some slight colour variation, the one bred locally being that in which the tone is dull red-brown, the ordinary spots large and pure white; a very noticeable white scale is situated at the base of the primary, this the more so as the basal area is concolorous and barely defined. In the other direction specimens become redder, or the lower median field of primaries may be strongly sprinkled with yellowish scales, giving a powdered effect. Its early history was unknown.

In July, 1904, the few accessible Hop-vines in the locality were examined for the borings of *Gortyna immanis*, this well-known species

being desired in the larval state for comparisons both in the home and other collections. Investigations of the plant disclosed a fearful state of insect depredation, quite enough to discourage any attempt at rearing the Hop here on a large scale. The root was our objective point for *immanis*, as by this date the young larvæ should have left the extremities of the vine and sought the more bulky root-stock for an abode. No larvæ are to be found, however, and attention turns to the other insect foes which are so sadly in evidence. Broods of coleopterous larvæ, accompanied by their parents presumably, have the foliage half riddled, and later this work is complete. They were assisted by four different species of lepidopterous larvæ, and a tiny Micro soon takes up an abode at the blossoming end, feeding upon forming seed-vesicles. A long cylindrical gall on a main stalk, upon being opened, discloses a nest of wriggling, yellow maggots, the young of the true gall-fly doubtless, since the growth seems to have been so recently formed. Surely the local Hop has enough to contend against without *immanis* at hand to gnaw them off at the root, since this is one of its tricks, as chronicled by the economic writers, and there would be no chance for the vines at all if the latter occurred here plentifully. Not recalling that the Hop was listed as being given to any gall-maker, causes some attention to centre here. A number of the galls prove more tapering and of larger diameter than the one first opened, and one is seen to have the end gnawed out in a peculiarly suspicious manner. A half-hearted search discloses a well-developed Gortynid larva, much discomfited at such reckless trespassing. And so this must be *immanis*, not working at the vine's tip nor down by the root as we have been informed, but midway in a tidy gall, one which in no way interferes with the plant's growth. Later on these larvæ are found to still cling to their comfortable galls, maturing there and producing no visible harm in the growth of the stalk. From which it would appear *immanis* has been a much-maligned species at the hands of the economic writers. But this conclusion was hasty.

Examples are secured for inflation, and a very few go on to pupæ in the breeding cage. A short pupal stage is followed by an emergence, not of the Guenée species, but the long-sought *circumlucens* of Smith. It so happened that the plants examined locally were widely separated, yet in every case there were numerous galls containing the *circumlucens* larvæ upon each, and they are so evident and plentiful that it becomes at once a most easy species to apprehend. It is recalled how in exchanging for

immanis with distant collectors, *circumlucens* often accompanied the former as representative of the locality, confirming the fact that we have here a general and preferred food-plant. But why has this larva been overlooked so long, especially where Hop is raised for a business, and where the work of *immanis* is so well known and deplored? It seems explainable only in that the *circumlucens* larva has been mistaken for the other, and its transformation never fully observed.

But while exploiting the doings of the gall-dwellers, a watch for the regulation procedure of *immanis* at the root was kept up, and while no larvæ or indications of their work appeared, a pupa occurred at the base of one vine, and a female imago on the same occasion was disturbed in the foliage. At this time the gall larva had just passed the final moult, and it appeared there must be great irregularity somewhere. So the final results were not quite so unexpected, the surprise being that the species should prove the very evasive *circumlucens*.

During the two succeeding years the life-history has been fully observed, one of the characteristic features brought out being the early emergence of the imago and the very short time which elapses at this period. Thus in 1905 a lot of twenty-two examples emerged in four days in the following order: two, sixteen, one and three respectively for the period named, and the same concerted appearance was noted in the brood of the succeeding year. With *nitela*, representing an opposite extreme, the emergence would likely run through twenty days in this number of examples. Under such circumstances, as might be expected, ova are deposited the first night, and are placed in clusters of three to six. Their form is spherical, flattened at the micropyle so this diameter is one-sixth less than a lateral measurement, and agrees with its congeners in sculpture and colour. The eggs are placed on and about the base of the vines, in any sufficient crevice, and pass the winter in this state. On May 28, 1905, the newly-hatched larvæ were observed at 10 a.m. ascending the vines and taking up their quarters, well toward the tip, where the parts are tender. At this date vines have grown six feet or more, and occasionally three or four larvæ locate in one stalk without serious detriment to its growth. The plant immediately notices the intrusion, however, in that the gall-like swelling at once begins. Sometimes a leaf petiole is entered, and then there is trouble shortly, the leaf withers, its stem turns yellow, and the larva makes a change of base to more stable territory, further on up the stalk. Growing so rapidly as does the Hop, every few days offers a point of vantage at an increase of stem, so that a larva subsequently ascending

may drill a cavity further on than its predecessor. Twenty minutes proves sufficient for ensconcing themselves from view.

The newly-hatched larva is of the usual delicate, semilooping character. The second stage finds them in a well-developed gall, which lengthens and enlarges as subsequent conditions demand. The third stage shows the typical *Papaipema* attributes in evidence, and we are able to place the larva in one of the three sections into which the group is divisible. The fourth stage is entered about July 1, and we find a larva belonging to the so-called *nitela* series, in which the dorsal line alone is unbroken and continuous. The colour is dark purple-lake, upon which the usual longitudinal dorsal, subdorsal and substigmatal lines show contrastingly drawn in white. The two latter stop abruptly on either side of the first four abdominal segments. The general features are normal; the thoracic shield edged with black, which continues as a noticeable line down the side of head. Spiracles black, tubercles not prominent.

In the penultimate stage we have a larva showing considerable individuality. The body is less cylindrical than usual, and is much flattened ventrally, length 33 mm. Head normal, side line has disappeared. The wrinkled skin on the three thoracic joints accentuates the slight constriction here. All tubercles bear well-developed setæ, plainly seen without a lens, and is a feature not equalled by other species. Tubercle iv a, on seventh abdominal segment, is wanting in this species. Neither spiracles nor tubercles are strongly shown, being nearly concolorous with the body, which is a pale brownish-clay colour. Dorsal line is alone unbroken.

At maturity the insect larva measures from 38 to 40 mm., and attains full growth about July 20th. The colour has faded to a neutral translucence, the principal comparative feature being the absence of the accessory tubercle iv a on joint ten. Pupation occurs in the ground, and lasts about twenty-five days.

The pupa is normal, more tapering posteriorly than some others; at the anal extremity are two divergent, slightly-hooked spines.

Considering the diameter of Hop-vines, the gall produced is rather singular. It takes the form of a cigar-shaped enlargement, from three to six inches in length and a half inch in diameter. The twining propensity of the vine makes it assume a crescent shape usually, and the larva always maintains a very large aperture at the lower end for ventilation and housecleaning. At maturity a large ragged opening is made at the upper end, through which the larva escapes. It is then eaten through to a very

thin shell in all places, for its bulk is really small to have sufficed for so lengthy a larval period. It is, in fact, one of those unexpected food-plants in which we occasionally meet our boring Gortynæ. That they should choose the stems of our largest plants, as *Helianthus giganteus*, *Heracleum lanatum* and such, appears fitting; or that a fleshy root like *Aquilegia* should be tempting is to be expected, but for a climbing vine, a delicate fern or the modest pitcher-plant to tempt them is beyond ordinary expectations. Notwithstanding, we have a major part of the life-histories of these borers now known, and at the price of eternal vigilance the others will be rounded-up some day.

The author would take this occasion to correct a former inference whereby it was assumed that the young larvæ of *Papaipema* hibernated in the first stage. The true facts are that the winter is passed in the egg state, and the young come forth about the first of June in this locality. The error occurred some years ago with the first ova ever obtained, when some minute mites ate out the contents of the egg, leaving the empty shells, from which it was presumed the larvæ had hatched. The following year the mites were caught in the act, and the true condition of affairs determined.

GEOMETRID NOTES

On the Genus Synelys, Hulst.

BY L. W. SWETT, BEDFORD, MASS.

Having received so many different forms of *Synelys alabastraria*, Hüb., from various collectors, I determined to straighten out the tangle in the group. To start with, of course, it was necessary to know just what *alabastraria* of Hübner (Zutr. exot. Schmett, ii, fig. 311, 1825 ?) was. In the first place, I found almost all writers on the subject had been guilty of spelling the name incorrectly; and secondly, that the plate differed from any Geometer known to me, as the three forms that occur with us have no ochreous under side, and the rust-brown markings on the upper side were different. At the beginning of my work I believe the various collectors placed the three forms as follows: 1, *enucleata*, Gn., as the form with large dark blotches on the fore and hind wings. This species also has often been misspelled. 2, *alabastraria*, as the form without dark blotches on fore and hind wings. 3, the form with a single black patch on inner margin of fore wings, and figured by Guenée (Plate 12, fig. 3) as simply var. A of *enucleata*, without name. I determined, therefore, to send all three forms to the British Museum to see under what names of Walker they would be.

Sir G. F. Hampson most kindly assisted me with the identifications, with the following reaults : that 1, the form with dark blotches on both sets of wings, is the *enucleata* of Guenée, the type being in Mr. R. Overthur's, of France, collection ; the description is so plain, and Packard has specimens compared with Guenée's type in his own collection, which I have seen, therefore I believe this form is correct. In regard to *S. alabastraria* (2), which Rev. G. W. Taylor was the first, I think, to strike from our list correctly, Sir G. F. Hampson stated it to be a foreign noctuid of the genus Palindia, from South or Central America, which is accurate, despite Hübner's locality; as one can see, it does not belong to the Geometridæ ; 2, the unspotted form, therefore, which was regarded as *alabastraria*, is left without varietal name, and going back we find the name *restrictata*, Walk. (Plate 13, fig. 52 of Packard's Monograph), which, being the oldest, should stand ; 3, the form with blotches on fore wings only was never named by Guenée or Walker, therefore I propose the varietal name *relevata* for it. Thus we have the three forms correctly placed. For information on the subject, I made use of Hulst's notes on Walker's types (Ent. News, Vol. vi, No. 3, p. 72); Grote (Trans. Am. Ent. Soc., ii, p. 82, 1868); Walker in Cat. Brit. Mus.; Guenée in Spec. Gen., 9, p. 505, 1857 ; Dyar in Psyche, 9, p. 165, 1901 ; Goodell, Can. Ent., XI, p. 194, 1879, and XII, p. 236, 1880 ; and lastly, Packard's Monograph and Holland's Moth Book. I am pleased to acknowledge the loan of specimens or help from the following gentlemen : Sir G. F. Hampson, Rev. G. W. Taylor, Dr. Dyar, Mr. Grossbeck, Mr. Broadwell, and Mr. Blackburn. I have a large series of specimens from southern, northern and western localities; my types of var. *relevata* are ♂, New Windsor, N. Y., 2, vii, 1897 ; ♀, New Windsor, N. Y., 22, vi, 1893 ; co-types ♂ in British Museum, ♀ in Boston Society Natural History.

The synonymy is as follows :

Synelys enucleata, Gn., Spec. Gen., IX, p. 505, 1857.

{ fig. 67, Plate 10, Packard's Monograph.
{ fig. 5, Plate 43, Holland's Moth Book.

var. *a. restrictata*, Wlk., Cat. Brit. Mus., Vol. 22, p. 722, 1861.

Syn.	mensurata,	"	"	"	"	"	35, p. 1621, 1866.
	continuaria,	"	"	"	"	"	35, p. 1622, 1866.
	reconditaria,	"	"	"	"	"	23, p. 786, 1861.

[*P. alabastraria*, a noctuid, drops from lists.]

var. *b. relevata* [fig. by Gn., Pl. 12, fig. 3, var. A], nov. var.

EUCHŒCA AGAIN.

In my last paper listing these species, I contended that *exhumata*, Pears., being a valid species, the name should stand. Recently, in studying the types of Tephroclystia in the Hulst collection at New Brunswick, N. J., I made the unpleasant discovery that the type of *inornata*, Hulst, is a worn specimen of *Euchœca exhumata*, Pears. My name must, therefore, give place to that of *Euchœca inornata*, Hulst, with *exhumata*, Pears., as its synonym. R. F. PEARSALL, Brooklyn, N. Y.

GALL GNATS OR CECIDOMYIIDÆ.

The Gall Gnats or Cecidomyiidæ are best known on account of the ravages of certain species, such as the Hessian fly, wheat midge, pear midge, and others. These relatively few species have inflicted enormous losses upon American agriculture in the last century. Representatives of this family present many interesting morphological variations, and possess marked differences in habits. There must be a very large number of species in America, as a recently-issued catalogue of Diptera lists over 750 European species referable to some 87 genera. We already have in our collections in the vicinity of 500 species of these small flies, and it would not be surprising were this number largely increased as a result of further collecting. The members of this family are all small, ranging in size from about .5 cm. to .5 mm., or even less. These insects have but few veins

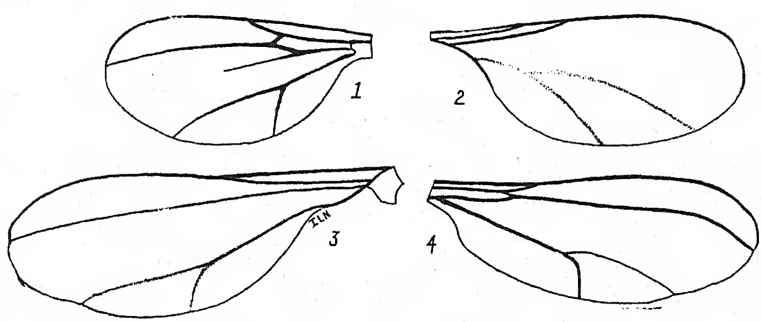


FIG. 6.—Typical Cecidomyiid Wings: 1, Campylomyza; 2, Lasioptera; 3, Mayetiola; 4, Porricondyla.

(fig. 6); the costal vein is continued along the posterior border of the wing, and is almost always narrower than the anterior border, while the

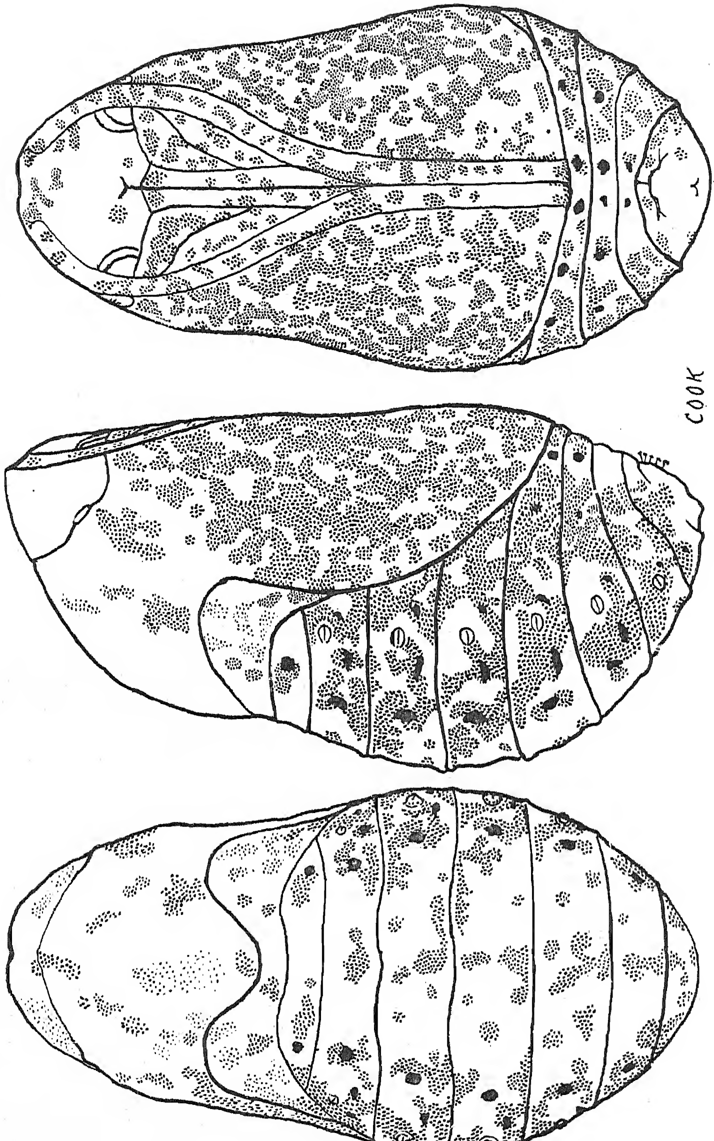
tibiæ are unarmed. The antennæ have from six to twenty-eight segments. Members of this group have a characteristic appearance, which, once recognized, enables one to easily separate most of the species from allied forms. The adults are usually yellowish or reddish, though some of the species are dark brown or even black.

Representatives of this family may be found at almost all seasons of the year, and in nearly every conceivable place. Some breed in decaying wood or under bark, others subsist upon low plant forms, such as fungi and lichens, some upon decaying vegetable matter, while a number of our better known species produce the familiar vegetable deformities so frequently associated with this family. Gathering the galls at the time when the insects are nearly ready to transform, often results in obtaining excellent specimens, though special collecting from various food-plants has proved far more prolific in species, but this latter method does not permit the definite association of the insect with its food-plant. Certain species appear to be closely limited to one plant, while others are capable of subsisting upon a variety. Some forms require an entire year to complete the life cycle, and others may produce several generations in a season. Field collecting is most successful in sheltered spots, or when there is comparatively little wind, and is apt to be more productive a day or two after a rain. We have found a window in an open shed a very satisfactory collecting place, provided it was kept free from cobwebs, and have succeeded in taking 10 species therefrom in as many minutes.

We have undertaken a serious study of this interesting group, and it is desired to enlist the co-operation of all interested in the advancement of science, as we wish to secure specimens from different sections of the country, in order that our studies may more adequately represent the American fauna. Adults may be taken in a close net, and from this transferred to a cyanide bottle, in the bottom of which there is a loose wad of absorbent cotton so that the insects will not shake around; they should then be put into either pill boxes containing absorbent cotton or placed in small vials with 50 per cent. alcohol. The latter should be filled with fluid, or, better still, a small amount of cotton may be inserted so that the insects can not float about, and in this way lose the terminal segments of the appendages.

E. P. Felt, State Entomologist, Albany, N. Y.

Mailed April 5th, 1907.



INCISALIA AUGUSTUS—CHRYSALIS.
(DORSAL, LATERAL AND VENTRAL ASPECTS.)

The Canadian Entomologist.

VOL. XXXIX. LONDON, MAY, 1907. No. 5.

STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

INCISALIA AUGUSTUS (continued from Vol. XXXVIII, p. 217, July, 1906).

An Error Corrected.—In 1878 Henry Edwards[1] described the mature larva and chrysalis of *Incisalia iroides* as follows:

" *Fam. Lycænidæ.*

" *Thecla irioides* (sic).

" Larva, full-grown: Carmine-red, covered with very short hair, each segment involute above, with deep double foveæ. Length, 0.50 inch.

"Chrysalis: Pitchy-brown, covered with very short bristly hair, swollen about the abdomen and much narrowed toward the head. Spiracles tuberculate. Wing-cases paler. Length, 0.40 inch."

The larvæ from which the above description was drawn were " taken near Summit Station, Sierra Nevada, July 12, 1877."

Scudder, who recognized *iroides* merely as a geographical variety of *augustus*,[2] applied Edwards's descriptions to the latter species.[3] No one hitherto appears to have questioned the propriety of this procedure, and the error has been repeated in all subsequent literature dealing with these butterflies. Comstock,[4] evidently relying upon Scudder's opinion concerning the value of the two forms, very naturally copies the mistake, and suggests that "it is quite possible that the larvæ of this species *(augustus)* in the east may have a different colour." Holland[5] also gives these descriptions as applying to *augustus*, and does not mention *iroides*. Wright[6] recognizes *iroides* as specifically distinct, but makes no mention of

1. Pacific Coast Lep. No. 27, " Transformations of Some Species not Hitherto Recorded." Proceedings of the Calif. Acad. of Sciences, June 17th, 1878.

2. Butterflies of the Eastern U. S. and Canada, p. 844.

3. Ibid, p. 844.

4. How to Know the Butterflies, p. 232.

5. The Butterfly Book, p. 247.

6. Butterflies of the West Coast, p. 210.

the larval or pupal stages observed by Edwards. Dyar (U. S. Nat. Mus. Bull. No. 52), Skinner (Synon. Cat. of the No. Am. Rhopalocera), and Smith, J. B. (List of Lep. of Boreal Am.) list *iroides* as a good species, and presumably regard it as such.

On a basis of the colours exhibited by the imago one might hesitate to separate *iroides* from *augustus*, so unreliable is the character of the ornamentation as a criterion for distinguishing between nearly related forms, especially when separated geographically. But where constant differences in size and coloration are correlated with other morphological differences, and where the larvæ are quite unlike in some particular, we are hardly justified in trying to explain the facts by assuming that both caterpillar and butterfly are subject to geographical variation, and that, despite the correlation between larval and imaginal characters within a given area, the forms are specifically identical. Even were the early stages entirely unknown, it would still be of greater advantage to regard the forms as distinct until they had been conclusively proven the same, than to regard them as the same until some one accidentally stumbled upon the disproof.

Iroides is undoubtedly a good species, and *the early stages described by Edwards do not apply to augustus.*

Previous Paper.—In 1904 I published,[7] in conjunction with Mr. H. Cook, a brief discussion of the larva and chrysalis of *augustus*, based upon a single specimen found on *Vaccinium*. The description of the mature larva there given was drawn from hasty notes made after a superficial examination during the evening of the day on which it was found. The examination was made with an ordinary reading glass, by gas light, and the notes were not referred to until the butterfly emerged. The description is faulty in two points. It was stated that the general colour was bright yellowish-green, the only markings being a faint, darker, dorsal stripe and a very minute coral-red spot in the middle of each segment just above the lateral fold. The "minute spots" spoken of are the spiracles, and of course are not present on all the segments. Moreover, they are not "coral-red," although they doubtless appeared so by contrast with the intense green surrounding them. It is further stated that the head was of a *uniform* light brown. This is also an error. The mandibles and labrum are indeed brown, but the ocellar fields are black, and the remainder of

7. Canadian Entomologist, Vol. XXXVI, p. 136 (May, 1904).

the head is nearly transparent, any colour which it may appear to have being due to the internal organs behind it.

Larva at Birth.—Pale yellow, with four series of long, recurved colourless hairs, two laterodorsal and two substigmatal; a series of short, straight, dusky, backward-directed bristles accompanying the laterodorsal series. Spiracles brownish. Head dusky-yellow above, labrum and mandibles rich brown, ocellar fields black. Length, 1.24 mm. Breadth head, .19 mm.

During the first instar the general appearance of the caterpillar alters but little. Being usually distended with food, the body appears to be nearly cylindrical, the segments smooth and rounded except for the substigmatal fold. As the first moult approaches the colour becomes tinged with green.

Second Stage.—Body onisciform, at first greenish-yellow, with a dusky dorsal stripe from the second thoracic to the eighth abdominal segment (in reality the dorsal blood vessel showing through the transparent skin) threaded by a light mediodorsal line extending to the seventh abdominal segment; a lighter cloud on the top of the laterodorsal ridge and a similar though less pronounced one on the side of the substigmatal fold, on each segment excepting the first thoracic and last two abdominal. Covered with short red-brown pile. Thoracic shield and spiracles brownish, the posterior edge of the former darker. Head (.54 mm. broad—from exuviæ) much as before.

During this stage the body becomes gradually greener until it is about the colour of young lettuce—a rather bright yellow-green quite unlike the watery pea-green of *irus* larvæ. The lighter parts of the laterodorsal ridge and the substigmatal fold do not stand out sharply, but blend with the ground colour, and form vague longitudinal stripes. Similarly coloured spots appear faintly on the sides just above the spiracle line.

Ultimate Stage.—Not differing from preceding stage at first. Later the colour deepens and becomes a vivid, intense green, with the following markings of a green-yellow: the slender mediodorsal line, broader laterodorsal and substigmatal lines—interrupted by the incisures—much as before. In addition, a series of short oblique lateral dashes, one to a segment except the first thoracic and last abdominal, fainter and usually much reduced on the second and third thoracic and on the seventh, eighth and ninth abdominal segments, elsewhere meeting the laterodorsal marks anteriorly, thus forming acute angles directed forwards; a faint cloud

around each spiracle, probably the vestige of a stigmatal stripe, as a similar spot, in line with the others, is to be found on the thoracic segments without spiracles. Spiracles yellowish-brown or buff; dorsal shield (thoracic) white or yellowish anteriorly, near the incisure livid or with a rosy tinge (possibly by contrast with the green), and studded with dark brown, slight elevations. Head above gray-green or brownish-yellow, labrum and mandibles rich brown, ocellar fields black. Pile red (?) brown—possibly also by contrast.

The body markings are evanescent, and are conspicuous for a day or two only, when the larva has attained its full growth, or a little before; they fade rapidly as the time for pupation approaches. The mediodorsal line grows fainter, and as it does so the indications of the stigmatal line appear. Then all the markings gradually fade, the line on the substigmatal fold being the last to disappear. While this is taking place the caterpillar eats little or nothing at all, the body grows shorter, the segments fill out, obliterating the laterodorsal ridges and reducing the folds and foveæ considerably. In one case the posterior half of the abdominal dorsum became tinged with dull russet-yellow, but as the chrysalis which was formed never disclosed an imago, this coloration was probably due to pathological conditions.

The Change to Chrysalis.—Having found the emergence of the pupa instructive in tracing the life-history of other species, I took precautions to witness it in the case of *augustus*. Slight peristaltic movement was noticed shortly after midnight (June 10th, 1906) in one of the larvæ fastened to its final mat. This was repeated at intervals for more than three hours, the peristalsis becoming more violent and the periods of rest less frequent, until at 3.23 a.m. the old skin split along the dorsimeson of the thorax. Three minutes later the exuviæ had been pushed beyond the body, the cremastral hooklets were fastened, and the insect was quiet.

The Chrysalis.—The newly-formed chrysalis was bright green on the head, thorax and wing-covers, gray-green on the abdomen ventrally, yellowish-white dorsally; the pulsating dorsal blood vessel (plainly visible on mesothorax, and second to seventh abdominal segments) dark green; incisures brownish-yellow; spiracles nearly white. Six series of shallow pits on the abdomen represent the principal foveæ of the larval skin; the lateral series largest, rounded; the infralateral smaller, elongate; the others minute. (See Plate 3.) The position of each pit is usually marked by a spot of black pigment beneath.

Very gradually the pupal skin hardened and became opaque; a dusky appearance was first noted about 4.30 o'clock, and at 6 o'clock this had deepened to light brown, with scattered spots of darker brown showing here and there. The number of the latter increased rapidly until 7.15 o'clock, when the pupa may be said to have attained its final characters.

In studying the chrysalis of this species I have had five specimens for comparison with twenty-two *irus* chrysalids, and from the material at hand I have been unable to discover any constant characters by which the two could be differentiated. The outline and general proportions differ in both with the sex of the inclosed insect, the female pupa being a trifle the larger, and relatively broader across the thorax. Of the two female *augustus* pupæ before me, neither is as large as the majority of female *irus* pupæ; but one of the latter is quite as small as either of the former. Perhaps the most obvious character, coloration, would be thought to present dependable criteria. This is, however, too variable to be of use; the chrysalis secured in 1903 was properly described as "dull reddish-brown, profusely sprinkled with pitchy-brown spots and irregular blotches less numerous . . . . . on the wing-cases than elsewhere." I have represented in the plate a chrysalis which shows the maculation *heavier* on the wing-cases than elsewhere The colour of the spiracles is also of no value; in some cases they are straw-yellow and conspicuous, in others brown like the ground colour, and in others black. The character and distribution of the hairs (not shown in the figures) is the same in both species, as is also the "raised reticulation" covering the whole surface. There is no "slender dorsal ridge" on the thorax.

THE PRESERVATION OF PAPERED SPECIMENS.

The loss of antennæ and other damage to papered specimens and the trouble of sorting out those desired when the papers are placed loose in a box, led me to devise ways and means of protecting them from damage. Thinking that some of our readers might be interested in a method of keeping specimens in good shape, I will describe how it may be done: Secure some shallow cigar boxes and cut pieces of card to fit loosely, over the card place a narrow strip of strong paper, about two inches from one end, and then other strips at about equal distances. The paper

strips should not be too tight; under these strips the paper envelopes can be tucked. The advantages of this method are that the flap of the envelope always remains closed. The name may be seen without the trouble of removing the envelope, and with a number of cards species can be filed away in their proper order.

When packing specimens for shipment a thin layer of cotton placed between each sheet will prevent much damage in transit.

The most convenient way to keep paper for envelopes is to get it cut into the shape desired and then put up in pads. These can be carried conveniently in the collector's bag, and are always ready for use.

Trusting that these hints may be of use to some of our collectors.

J. Wm. Cockle, Kaslo, B. C.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 20.

A Homemade and Effective Insect Trap.

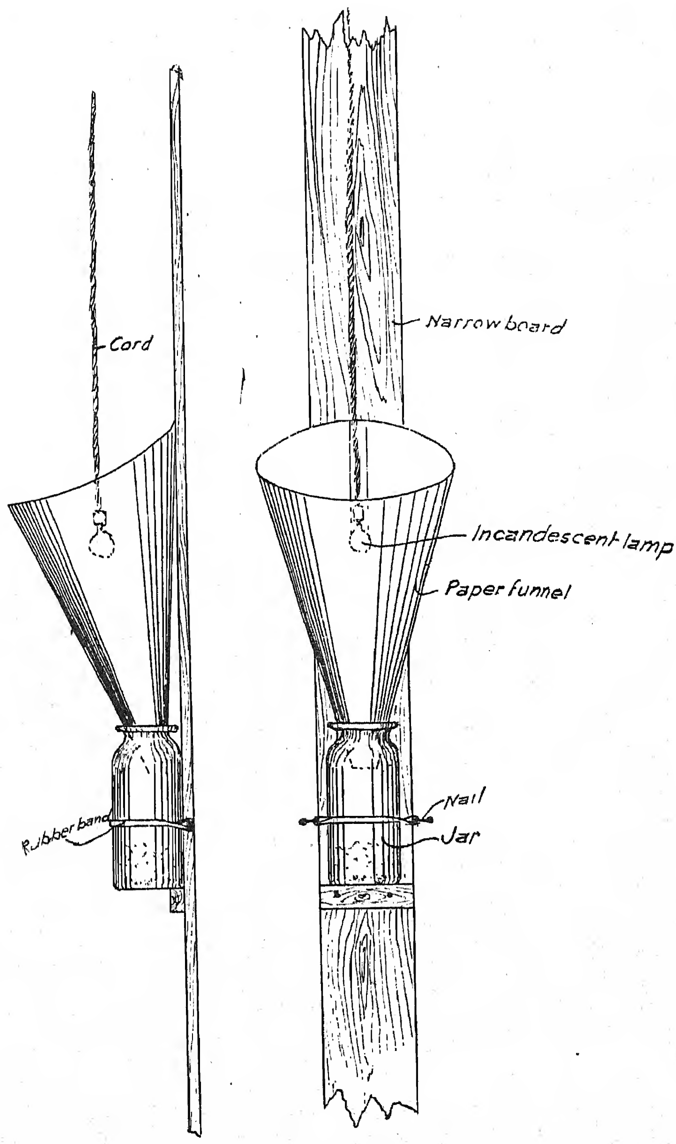
BY JOHN D. EVANS, TRENTON.

For several seasons past the writer has used an insect trap of simple construction, and with such good results that he offers the idea to anyone who may wish to try the experiment the coming season.

The light used is an incandescent lamp of 16-candle power, suspended from the cornice in front of the porch, the entrances thereto being at the sides.

The trap consists of a funnel made of a half-sheet of double elephant drawing-paper (other paper of like colour, strength and stiffness will probably answer), with the light so placed that it is just below the top of the funnel. The paper being translucent, the funnel becomes a large luminous object, and seems to be most attractive for myriads of insects of nearly all the orders. The lower part or small end of the funnel is inserted in the neck of a large wide-mouthed bottle or deep jar, into which it fits tightly and extends down about one-fourth of the depth of the bottle. In the bottle is placed a liberal supply of lump cyanide of potassium, sufficient, in fact, to cover the bottom, and then about one-third of the depth of the bottle is filled with cotton batting. Insects that once enter the bottle very rarely can escape again, and the strong fumes so quickly overpower them that fresh specimens are seldom, if ever, injured.

INSECT TRAP



SIDE VIEW FRONT VIEW

The construction of the apparatus will readily be understood, and the application thereof, by the diagram and the following description: Take a strip of board four or five inches wide, or about as wide as the diameter of the jar, by one half inch or three-quarters inch thick, and long enough to reach up from the ground to the cornice, and when so placed it will be about five or six inches back from the suspended lamp. The funnel having been formed out of the sheet of paper, being about twelve or fourteen inches in diameter at the top and about one and one-quarter inches at the bottom and about fifteen to eighteen inches high, is secured to the strip of board with a thin narrow batten or lath nailed on the inside of the funnel and through to the board at such a height that when in place the light will be just below the top of the funnel. The bottle or jar is then put in place, with the mouth tightly fitting against the outside of the funnel, and is retained in its place by a narrow cleat nailed on the board and up against the bottom of the jar, and is kept rigid with an elastic rubber band passed around it from side to side, about half way up its height, and the band slipped over a nail driven into the edges of the board. The jar can be removed instantly at any time by simply disengaging the rubber band from the nails.

The board, with funnel attached, may be kept in some suitable place when not in use. At the approach of dusk the bottle is slipped into its place and the board set up behind the lamp, if the board is of the proper length no other means is required to keep it in place except contact with the ground and cornice. The trap is left out all night to entice all winged inquisitive individuals, and is taken down in the morning, the jar removed and stopper put in. On the approach of the following evening the contents may be removed and the trap again set. The operator will have a full evening's entertainment assorting the material of the previous night's catch, taking care of the prized individuals and noting the common species.

During some evenings insects may be much more numerous than upon others, but the writer has repeatedly noticed that no matter how unpropitious the early part of the evening may be, the morning may find some highly-prized object an inmate of the trap, and by keeping up the trap-setting nightly, from early until late in the season, one is enabled to capture not only the transient fliers, but also to note the dates of the coming and going of those species which are on the wing for a lengthened period.

The details of installing the trap may of course be varied to suit the requirements of the situation.

NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

(Continued from page 128.)

Eucosma Hamptonana, sp. nov.

Expanse, 12.5 to 14 mm.

Head very pale fawn; palpi white fawn, with a darker dusting on outside; antenna dark fuscous, fawn-white between joints; thorax darker fawn than head, posterior half streaked with blackish; abdomen grayish-fuscous, anal tuft with an ochreous tinge; legs whitish-gray, anterior pair dusted with fawn above, and tarsi ringed with black.

Fore wing light tawny-fawn, with a large white dorsal spot, white dashes on costa, and strigulated with black on costal and dorsal margins. The basal area is limited on lower half of wing by white dorsal mark, on upper half it is not clearly defined; on the fold are two black dots, and the male costal fold, which extends to middle of wing, is marked with black dashes, with a corresponding line of blackish dots below; the dorsal margin is similarly marked with black dashes, and the inner edge of the white patch is outlined with black. The white dorsal patch is large, extending from middle of dorsum to tornus, beneath ocellic spot, with two or three dark dots on lower edge; the inner edge curves obliquely outward to above middle of wing, it then follows fold to tornus; outwardly it is somewhat overlaid with fawn and black scales. Between the white patch and costa is a gray shade; beyond this the costa is marked with four long geminate lines, white on costa and shining gray below. Each encloses a small black costal dot, and is separated by a larger black spot; the line below apex curves outward in termen, ending in a white dot below apex. The ocellic area is large, the vertical bars purplish-gray-metallic, the inner is double the width and length of the outer, and above connects with the inner pair of costal lines, below it expands outward beneath the ocellus; in the fawn-coloured ocellus are four or five short black lines and dots, and there is a patch of black on the inner side of the inner bar. Terminal line black, cut with white below apex. Cilia shining leaden-gray.

Hind wing smoky-gray, darker at apex. Cilia whitish, with a darker basal line. Under side yellowish-gray. Under side fore wing dark smoky-gray, blackish towards termen; costal spots repeated.

The description is from a ♂ specimen; the ♀ differs in that the dorsal patch is gray instead of white; the ♀ is also darker, black and brown scales overlay the fawn.

Five specimens: Hampton, New Hampshire, July 7 to Aug. 5, S. Albert Shaw.

Enarmonia Shawiana, sp. nov.

Expanse, ♂, 11.5 to 12 mm.; ♀, 9.5 to 14.5 mm.

Head light olivaceous brown on top, darker on sides, white in front; palpi, ♂ pure white; ♀ cream-white; the outer end of tuft and apical joint smoky-brown; the ♂ palpi are shorter than ♀; antenna fuscous; thorax dark brown in middle, the patagia and an anterior band of grayish-brown, a few whitish specks on posterior end; abdomen dark velvety-brown above, anal tuft gray; legs grayish-white, shaded in front with blackish-brown.

Fore wing blackish-brown with a bronzy-tinge, a conspicuous white dorsal mark and four white costal dashes in outer half. The basal area extends to inner third, its outer edge is generally rounded with indentation at upper and lower fourths; on this lower half is a small patch of white scales, above which a streak of bluish-metallic nearly touches costa. The white dorsal mark is in middle of wing, it is irregular in form, in some specimens with a slight spur from its outer upper corner, in others it is somewhat bifurcated at the upper end with a few dark scales on dorsum; in all specimens it slightly angles outward, and rarely reaches above fold; an inwardly inclined fascia of shining-blue continues from its upper edge to costa, ending on costa as a geminate white spot. Beyond this is a broad fascia of the ground colour, thickly dotted with dull black on costa, and more sparsely on upper half below costa, and lightly with olivaceous-brown on lower half. The outer half of costa is marked with four large white oblique costal streaks, the one before apex is the largest, and in some specimens it is geminate; the inner costal dash sends a curved leaden-blue-metallic line to anal angle, its lower half broadening and forming the inner vertical ocellic bar. Beyond this metallic line the ground colour is coppery-brown, horizontally streaked with black, between the white costal dashes the costa is narrowly edged with black. From the second and third costal dashes a similar leaden-metallic line curves under the apex before the termen, and ends in termen as a white dash about a third above tornus. The outer costal dash is edged below with leaden-metallic scales, opposite its lower end, but not joining it is a white dash below apex. The ocellic area between the two metallic bars is bright coppery-brown, crossed by four or five horizontal black lines, with an indistinct metallic line below. Terminal line black, cut with white dashes below apex at lower third and twice on tornus. Cilia white at apex, leaden-gray below, preceded by a whitish basal line.

Hind wing dark smoky brown, blackish-brown outwardly. Cilia whitish-gray, with a black basal line. Under side both wings grayish-brown, costal spots of fore wing repeated.

Described from two ♂ and seven ♀ specimens. Essex County Park, N. J., July 1 to 17; Newark, N. J., June 9, A. J. Weidt; Hampton, N. H., June 10, S. Albert Shaw.

The New Hampshire specimens are all large, the ♂ 11.5 to 12 mm., and the ♀ 14 to 14.5 mm. One of the New Jersey specimens, from Newark, a ♀, is 13 mm., and seems to be of the same race as those from New Hampshire; the other four New Jersey specimens, all ♀'s, are of a much smaller race, expanding 9.5 to 10.5 mm.; I was inclined to separate them, but most minute examination fails to show any specific difference. This species is closest to *E. bracteatana*, Fern., and the larvæ are likely to be found in the cone scales of some of our eastern Conifera, as is the habit of Fernald's species in California.

Named in honour of Mr. S. Albert Shaw, of Hampton, New Hampshire, to whom I am indebted for a great many carefully-collected and exquisitely-mounted specimens.

Proteopteryx Marmontana, sp. nov.

Expanse, 12.5 to 18 mm.

Head brownish-gray; palpi dark gray, paler within; thorax bronzy-black, posterior end and patagia streaked with white; antenna and abdomen dark fuscous; legs whitish, dusted and banded with bronzy-black.

Fore wing: Inner half bronzy-brown, heavily overlaid with gray, the ground colour gradually becomes lighter outwardly, until in the apical third it is bright coppery-brown or ochreous. There is a large white dorsal spot between inner and outer third on lower half of wing, dotted with blackish-brown on dorsal edge, and in some specimens a few dark scales above; the inner edge is outwardly oblique and indented below fold, a short spur follows fold on its outer edge, but excavated beneath. Above this spot a broad double geminate gray fascia continues to costa. The basal area outlined by this fascia and dorsal spot is edged with black scales, in the middle of its lower half is a grayish shade. Beyond the fascia and dorsal spot is a curved coppery-brown fascia, black on costal edge, dotted with black below fold and on dorsal edge, and a few black scales on its outer edge before the ocellus. Beyond this a pair of geminate costal spots send a double geminate band of shining-gray to ocellus, the latter pure white, shining on the sides and mixed with a few shining gray scales, the centre is tinged with ochreous and crossed by three horizontal black lines in the upper half. There are two other

geminate costal dashes between the above and apex, the inner sends a horizontal gray-metallic line to termen beneath apex, it nearly joins a shorter leaden line from the outer dash. The costal dashes are narrowly white on costal edge, each contains a small black costal dot, and between each two the costal edge is narrowly black. Cilia brown at apex, gray in middle of termen and whitish around tornus.

Hind wing light smoky-gray, cilia whitish-gray, with a faint darker basal line; under side the same. Under side fore wing dark gray, costal spots faintly repeated.

The description is from a ♂ specimen from Rounthwaite, Manitoba. The New Hampshire specimens are smaller, and more of a dark browish-hue inwardly and ochreous outwardly. Without a lens the Manitoba specimens look almost black in the inner half.

Twenty-one specimens: Rounthwaite, Manitoba, July 11 to 15, L. E. Marmont; Aweme, Manitoba, July 12 to 24, Norman Criddle; Prince Albert, Alberta, July 19, T. N. Willing; Regina, Assiniboine, July 15, Dr. Jas. Fletcher; Hampton, New Hampshire, Aug. 5 to 10.

This species is nearest *P. momonana*, Kearf., it can be separated by the ocellic spot, which in *Marmontana* has a well defined dark dot in its upper half, also by the inner edge of the ocellus, which in *Marmontana* is straight, while in *momonana* it sends a spur into the dark fascia before it.

I take pleasure in naming this interesting and well-distributed species after Mr. L. E. Marmont, to whom I am indebted for a great many beautifully-prepared specimens of Micro-Lepidoptera.

Epinotia Normanana, sp. nov.

Expanse, 9 to 10.5 mm.

Head and palpi whitish fawn, latter with blackish-brown shade on outside of second joint; antenna grayish-white; thorax light fawn, a faint dark shade in middle of posterior half; abdomen silvery-gray, anal tuft light cinereous, with a few dark scales at its base; legs whitish-fawn, dusted and banded with dark brown.

Fore wing very light fawn, mixed with whitish scales, with large, well-defined black costal dashes, terminal line and dusting. The basal area is only defined on the lower two-thirds of wing, when it reaches to inner third the area is pale fawn, with three vertical black lines on its outer half, the inner only reaching costa, and one black vertical line in the middle of the inner half, with a black dot between latter and base and a slight dusting of black between these lines on the dorsal half. The costa, from base to apex, is evenly marked with black dashes, the three before

apex being very large, triangular in shape and oblique; they are separated by white costal spots, each containing a small black costal dot; the outer white spot sends a white line into termen below apex, through black terminal line into cilia, it encloses a blackish apical spot. The pearly-white, shining ocellic bars are joined together below, and enclose a narrow fawn space, dotted with black, above it is a larger black shade. On the outer third of dorsum is a shining pearly-white dot; between it and the inner ocellic bar the ground colour is rather heavily powdered with black. There is a broad central fascia of ground colour, edged inwardly with white, and in middle near dorsum dotted with black, and a few blackish scales scattered through the centre. Terminal line black; cilia leaden-metallic.

Hind wing gray; cilia paler gray, with a darker basal line. Under side the same. Under side fore wing darker gray, costal spots faintly repeated. Cilia leaden-metallic, with black basal and terminal lines.

Fourteen specimens: Aweme, Manitoba, all collected June 27, 1905, by Mr. Norman Criddle, in whose honour the species is named.

Epinotia Kennebecana, sp. nov.

Expanse, 13 to 15 mm.

Head light fuscous; palpi cream white inside, light fuscous outside, apical joint dark fuscous; thorax dark fuscous, tips of patagia light gray; abdomen fuscous, anal tuft cinereous; legs cream-white, shaded with dark brown.

Fore wing: Basal area blackish-brown, a dark gray shade extends from basal area along costa to apex, and is continued as a narrow black terminal line to tornus. Enclosed in these dark and gray shades, the entire outer two-thirds of wing are white; the usual white dorsal spot and an abnormally large white ocellic spot joining together, but their relative positions indicated by a shade of scattered gray and black scales between them. The basal area on dorsum extends to inner third, its outer edge is slightly outwardly oblique to above middle of wing, then obliquely inward to costa; the lower two-thirds is finely dentate. The gray costal shade is marked with four paler geminate spots on the outer half, and before the apex the gray and white is shaded with a yellowish-coppery tinge. The ocellic spot is defined on both sides by vertical shining white bars, each outlined with black scales. Cilia black, divided by a gray line on lower half.

Hind wing light smoky-gray, cilia paler, with a gray basal line. Under side grayish-white, shaded with brown along costa. Under side fore wing smoky-black, costal spots faintly repeated, grayish-white below fold.

Three specimens: Kennebunkport, Maine, August, collected by G. H. Clapp. In collections of Carnegie Museum, Acc. Cat. No. 2351 and 2861.

Co-type in Carnegie Museum.

Acleris albilineana, sp. nov.

Expanse, 21–23 mm.

Head, palpi, antenna and thorax dark hoary-gray, with a purple reflection; posterior end of thorax and patagia ferruginous-purple; abdomen gray, anal tuft dull ochreous; legs grayish-white, dusted and banded with dark brown and ochreous.

Fore wing dark grayish-lavender, with a conspicuous pure white band from base to costa before apex, on the upper third of the wing. At the extreme base the band begins on the costa, but does not touch it again, except at the outer end; the sides of the band are parallel, and it only diminishes in thickness just before the outer end. Above the white band is a costal band of ground colour of about the same width. Below the white band and outlining it the ground colour is darkened by deeper purple and black scales, and with four or five dots of black raised scales in the middle of cell, sometimes with a ferruginous shade. There are three black dots of raised scales in fold, the larger at inner third, another at outer third, and the smallest at outer end of fold. Cilia concolorous.

Hind wing bright shining gray, with a yellowish hue, cilia the same; under side the same, but speckled with dark brown. Under side fore wing shining cinereous-gray, paler along costa.

Ten specimens, Ottawa, Canada, Sept. 23 and April 21, C. H. Young; Hampton, N. H., Oct. 18 and 20 and Mar. 28 to May 2, S. Albert Shaw.

This species is very much like *Acleris divisana*, Hbn. I have not seen the European species, but if Robinson's figure 63, Pl. vii, Trans. Am. Ent. Soc., Vol. II, 1869, is a good representation of it, *albilineana* can be separated by the following differences: white band does not reach apex; white band is straight on its lower edge, not angulated; white band does not touch costa except at its two ends.

Archips argyrospila, Walk., variety *mortuana*, var. nov.

Expanse, 18 to 20 mm.

Head dark bronzy-gray, collar shaded with pale ochreous; palpi pale ochreous inside, brown outside, terminal joint blackish; antenna gray; thorax shining-gray; abdomen slightly paler than thorax, tuft whitish-gray; legs ochreous-white, heavily dusted in front with bronzy-black.

Fore wing: Shades of light and dark gray. There is an inner fascia of shining-gray, beginning on costa as a quadrate white spot between inner fourth and third, below costa it widens, and at dorsal margin it extends from inner fourth to beyond middle; in male specimens the dark grayish-brown costal fold partly hides the white spot. There is a similar quadrate outwardly oblique white spot between costa and top of cell beyond middle, below cell it continues as a shining-gray fascia, and overspreads the outer third of wing. A smaller inwardly oblique white spot is on costa before apex; these two white costal spots enclose a darker shade of gray, and in some specimens there is a paler shade connecting the two spots below the dark spot. Cilia pale, shining gray.

Hind wings gray, cilia whitish; under side whitish. Under side fore wing smoky-gray, paler around margins, with costal spots repeated.

Four specimens: Ottawa, Canada, July 3, C. H. Young; New Brighton, Pa., June 20, F. A. Merrick; Wisconsin; San Francisco, Cal. (Strecker collection). I have two other specimens, one from Algonquin, Ill., June 29, Dr. Nason, and one from So. Utah, July, Dr. Barnes, too badly rubbed to include in the type material.

The maculation does not differ from *argyrospila*, but there is a total absence of red, brown or ochreous shades, these being entirely replaced by grays. The variety seems to be as widely distributed as the common form.

Phalonia Hollandana, sp. nov.

Expanse, 13 to 14 mm.

Head, palpi and thorax cream-gray, dusted with light brown; antenna gray; abdomen dark gray, anal tuft dull ochreous; legs cream white, dusted with brown in front.

Fore wing: Basal area cream-white, mottled in the middle with light olivaceous and edged on costa with pale purplish-pink, in which are a few brown dots; its outer margin is nearly straight and very oblique, extending from inner fourth of dorsum to beyond inner third of costa. Beyond it is a black fascia, narrowest on costa, overlaid in middle with purplish-brown, and on lower end with pinkish and cream-white scales; its outer edge is concave, and encloses a large round spot filling the outer third of wing, edged with shining-purple and interior dull reddish-purple, shaded with black outwardly and above. The outer half of costa is purple, interrupted by a black spot before apex, which sends a narrow black fascia into the round spot. There is a black patch in apical cilia, and five others in the termen cilia; between these black spots the cilia is ochreous-pink, and is preceded by a fine black line, before which is a whitish line.

Hind wing blackish-gray; cilia paler, with a broad darker line close to base; under side dark gray, mottled outwardly with black in middle of wing; cilia preceded by a fine ochreous line. Under side fore wing smoky-black, dotted with cream-white on outer half of costa.

Three specimens: Oak Station, Allegheny Co., Penn., Sept. 1, Fred. Marloff; Pittsburg, Penna., Sept. 12 and 21, Carnegie Museum, Acc. No. 2960, through Dr. W. G. Holland, in whose honour the species is named, and to whom I am indebted for the privilege of studying and identifying a large number of most interesting specimens of Micro-Lepidoptera.

Commophila contrastana, sp. nov.

Expanse, ♂, 20 mm.; ♀, 21 mm.

Head and palpi cream-white; antenna, basal joint white, shaded with brown; outer joints light whitish-fuscous; thorax and patagia purplish-black, with an iridescent blue and red reflection; abdomen and legs ochreous-cream, latter shaded in front with brown.

Fore wing: Upper half and outer third cream-white; a sharply-defined band of bluish-black, with an iridescent reflection, as on the thorax, occupies the dorsal edge of the wing. This band begins on costa, covering the inner sixth; it covers the basal area, the outer edge, is outwardly oblique to lower third of wing, where it curves and continues parallel to dorsum; the band is slightly wider at outer end, and terminates before the ocellic space. Paralleling the apex in the outer fourth is a shade of light olivaceous-fuscous, with a cluster of leaden scales before apex, divided into four lines by shining-cream strigulæ from the costa. Between middle and outer third there is a quadrate spot of same shade on costa. Cilia cream-white.

Hind wing light brownish-fuscous, darker around margin; cilia whitish; under side ochreous-white. Under side fore wing light ochreous-brown; shining gray-white below fold.

One ♂, Oak Station, Allegheny Co., Penn., May 23, Fred. Marloff; one ♀, New Haven, Conn., June 7, A. E. Britton.

This species is very closely allied to *C. fuscodorsana*, K., and may prove to be the eastern form of this western species. The dorsal band in *fuscodorsana* sends a spur up to end of cell at its outer end; the strigulations in apex are much darker and limited to two well-defined broader lines. The shade of the dorsal band is fuscous-brown.

Correction.—On pages 5 and 6 *ante* read, "University of Kansas" in the place of "Kansas Academy of Science."

(To be continued.)

LIST OF HEMIPTERA TAKEN AT COMO, QUEBEC.

BY GEO. A. MOORE, MONTREAL.

The following list enumerates the Hemiptera taken by me at Como, Quebec, which is about 30 miles west of Montreal, from the 1st of July to the 3rd of September, 1906. All these insects passed through the hands of Mr. E. P. Van Duzee, who kindly named them for me. The dates given are the first day the insect was seen or taken :

Heteroptera.

Pentatomidæ.

Corimelæna unicolor, P. B.—Aug. 19. Common on Golden-rod.
Corimelæna pulicaria, Germ.—July 24. Common on Golden-rod.
Eurygaster alternatus, Say.—July 26. Several.
Sehirus cinctus, P. B.—July 24. One specimen.
Euchistus fissilis, Uhl.—July 26.—Several.
Euchistus tristigmus, Say.—July 2. Several.
Pentatoma juniperina, Linn.—July 21.—One specimen.
Mormidea lugens, Fab.—Aug. 1. Several.
Cœnus delius, Say.—Aug. 4. One specimen.
Neottiglossa undata, Say.—July 26. Several.
Cosmopepla carnifex, Fab.—July 1. Common.
Menecles insertus, Say.—July 26. One immature specimen.
Banasa dimidiata, Say.—Aug. 12. One specimen.
Podisus modestus, Dall.—Aug. 18.
Elasmostethus atricornis, Van D.—Sept. 1. Common.

Coreidæ.

Alydus eurinus, Say.—July 20. Several sweeping.
Alydus 5-spinosus, Say.—July 26. Three specimens taken sweeping.
Protenor Belfragei, Hagl.—Aug. 2. Two specimens taken sweeping.
Corizus novæboracensis, Sign.—July 27. Several sweeping.
Corizus nigrosternum, Sign.—July 8 and Sept. 3. Several sweeping.

Berytidæ.

Zalysus muticus, Say.—July 26. Common on Raspberry.

Lygæidæ.

Nysius angustatus, Uhl.—July 24. Common.
Nysius longiceps, Stal.—July 25. Two specimens taken sweeping meadow.
Cymus claviculus, Halm.—July 2. Common in swampy places.

Œdancala dorsalis, Say.—July 15. Common sweeping railroad track.

Ligyrocoris diffusus, Uhl.—July 14, Aug. 11. Common.

Ligyrocoris contractus, Say.—July 26. Several.

Perigenes constrictus, Say.—Aug. 3. Three specimens taken.

Lygæus Kalmi, Stal.—Sept. 3. Two specimens taken on milkweed.

Phlegyas abbreviatus, Uhl.—July 26. Several sweeping railroad track.

Scolopostethus Thomsoni, Reut.—July 2. One specimen.

Tingitidæ.

Corythuca juglandis, Fh.—July 24, Aug. 1. Common on Oak and Elm.

Corythuca marmorata, Uhl.—July 26. Two specimens on Oak and Elm.

Aradidæ.

Aradus abbas, Prov.—July 1. One specimen.

Phymatidæ.

Phymata erosa Pennsylvanica, Hand.—July 14. Common on Golden-rod.

Reduviidæ.

Coriscus subcoleoptratus, Kirby.—July 1, Aug. 4. Several.

Coriscus ferus, Linn.—July 2. Very common.

Coriscus inscriptus, Kirby.—Aug. 14. One specimen

Sinea diadema, Fabr.—July 26. Very common on Golden-rod.

Diplodes luridus, Stal.—July 21. Immature on Elm trees.

Reduvius personatus, Linn.—July 29. Three came to light.

Anthocoridæ.

Anthocoris musculus, Say.—July 25. Common on shrubs.

Triphleps tristicolor, B. White.—July 2.

Capsidæ.

Plagiognathus obscurus, Uhl.—July 2.

Plagiognathus politus, Uhl.—July 15.

Plagiognathus annulatus, Uhl.—July 2.

Rhinocapsus Vanduzei, Uhl.—July 25.

Diaphnidia pellucida, Uhl.—July 15.

Orthotylus chlorionis, Say.—July 8.

Hyaliodes vitripennis, Say.—July 20.

Dicyphus agilis, Uhl.—July 8. Common.

Dicyphus famelicus, Uhl.—Aug. 3. Common.

Stiphrosoma stygica, Say.—July 1, Aug. 12. Common.
Halticus bracteatus, Say.—July 18. Common.
Pilophorus crassipes, Stal.—July 24. Two specimens.
Pilophorus amœnus, Uhl.—Aug. 4. One specimen.
Monolocoris filicis, L.—July 2. Very common.
Resthenia insignis, Say.—Aug. 3.
Lopidea media, Say.—July 26. One specimen.
Phytocoris eximus, Reut.—July 15. Common.
Phytocoris puella, Reut.—Aug. 2.
Phytocoris pallidicornis, Reut.—July 14.
Calacoris rapidus, Say.—July 1. Common.
Melinna modesta, Uhl.—July 20, Aug. 1.
Lygus pratensis, Linn.—July 1. Very common.
Lygus invitus, Say.—July 14. Common.
Lygus pabulinus, Linn.—Sept. 1. One specimen.
Orthops scutellatus.—July 7.
Pœcilocapsus lineatus, Fabr.—July 1. Common.
Pœcilocapsus goniphorus, Say.—July 8.
Pœcilocapsus marginatus, Reut.—July 8.
Camptobrochis nebulosus, Uhl.—July 21.
Neoborus saxeus, Dist.—July 21.
Capsus ater, Linn.—July 8.
Collaria Meuilleuri, Prov.—July 15. Common.
Trigonotylus ruficornis, Fall.—July 2.
Miris affinis, Reut.—July 2. Common.
Leptoterna dolabrata, Linn.—July 1. Common.
Fourteen species of Capsids not determined.

Saldidæ.

Salda pallipes, Fabr.—July 7. Common on shore.

Notonectidæ.

Plea striola, Fieb.—July 31. Common.

Gerridæ.

Microvelia Americana, Uhl. ?—July 31. Immature ; common.
Gerris marginatus, Say.—July 23. Common.
Gerris sulcatus, Uhl.—July 31. Common.
Limnoporus rufoscutellatus, Lati.—July 31. Common.
Mesovelia bisignata, Uhl.—Aug. 1. Common.

(To be continued.)

THE *EUPITHECIÆ* OF EASTERN NORTH AMERICA.

BY GEO. W. TAYLOR, WELLINGTON, B. C.

In the present paper an attempt is made to enumerate the species of *Eupithecia* occurring in the eastern parts of North America.

The species of this genus, being very numerous and not very easy to distinguish the one from the other, have been neglected by most entomologists, and in the majority of collections they are present in short series only, and usually under incorrect names.

The Monograph of Dr. Packard, which for so many years was our only guide, enumerated but 17 species from the whole of North America. Naturally it was impossible to identify one's captures from that work. Then came Dr. Hulst with 40 or 50 new species, but I am compelled to say that his descriptions are in most instances altogether inadequate, and the fact that in no single case was a description accompanied by a figure, makes the identification of Hulst's species a matter of considerable difficulty.

But even Hulst left many forms undescribed. Species of *Eupithecia* will, I believe, be found to be quite as numerous in North America as in Europe. I have already over 100 species in my own cabinet, and I shall not be surprised if in the near future our list attains a total of 150 names.

Coming from the district covered in the present paper I recognize about 40 apparently distinct species. I have endeavoured to separate first the species described by Guenée, Grote, Packard and Hulst, and have ventured then to characterize the rest as new to science. I have tried to make my descriptions as full as possible, and have taken into consideration the under as well as the upper sides. Hulst usually omitted reference to the under sides, but I find that the arrangement of the lines on the fore and hind wings beneath often furnishes reliable and easily-recognized specific characters.

I have to confess that I have not yet attempted to break up the genus into sections. I have, indeed, neglected so far the study of generic characters, believing it to be of greater importance first to fix with certainty the specific status of the forms already described and to supply the undescribed ones with names.

The generic nomenclature of our *Geometridæ* is in great confusion, and in danger of being made still worse if hasty revision is attempted. I believe that some of the characters (sexual ones) relied on by Dr. Hulst

for the separation of genera will be discarded altogether by future systematists, but I am far from competent myself to undertake or even suggest reforms in that direction.

As to the name adopted for this genus, I use *Eupithecia* because I agree with those who claim that Curtis's name antedates that of Hubner. There are some, I know, who hold the contrary opinion, and they will continue to call the genus *Tephroclystia*, but it is to be hoped that the error, into which nearly all our modern American writers have fallen, of writing *Tephroclystis* will not be perpetuated. I am not sufficiently acquainted with European literature to know who first made the mistake, but certainly Meyrick in his "Hand-book" uses the wrong spelling, and I think that probably Hulst and others have erred by following him.

With the species already described I shall deal in date order.

The names proposed prior to 1896, the date of Hulst's "Classification," are 18 in number.

In order of publication they are :

1759,	absynthiata, Clerck.	1867,	luteata, Packard.
1847,	scriptaria, Herrich Schaeffer.	1873,	geminata, Packard.
1857,	coagulata, Guenée.	1873,	palpata, Packard.
1860,	gelidata, Möschler.	1873,	interruptofasciata, Packard.
1861,	hyperboreata, Staudinger.	1873,	strattonata, Packard.
1862,	anticaria, Walker.	1874,	cretaceata, Packard.
1862,	implicata, Walker.	1876,	albicapitata, Packard.
1862,	explanata, Walker.	1876,	zygadeniata, Packard.
1863,	miserulata, Grote.	1876,	ravocostaliata, Packard.

Eup. absynthiata, Clerck, Icones, VI, 9, 1759.—This species is dealt with here, not because it occurs in North America, but because the *name* has appeard on all our lists from the time of Packard to the present day.

We have, it is true, several close allies to this species, which will be mentioned later, but the true *absynthiata* has not yet, I believe, been found in America. We have no form nearly so *red* as the genuine *absynthiata* is, and, moreover, in all our forms, so far as I known them, the fringes are *checkered*, while in the European moth the fringe is plain.

Careful breeding of our forms and investigations as to their food-plants will be necessary to make certain their specific distinctness and limits. The larva of the supposed *absynthiata* has been found and

described in North America (See Goodell in CANADIAN ENTOMOLOGIST, Vol. IX, p. 62; food-plant, Cockscomb), but it is not possible now to say to which of our species this description will refer. The larva of the real *absynthiata* of Europe feeds on the flowers of species of *Senecio, Eupatorium, Artemisia, Achillea* and *Solidago.* It is described by Packard (Monograph, p. 50), who quotes verbatim from Newman (British Moths, p. 136), but Newman is there quoting from Crewe (Entomologists' Annual, 1861, p. 140) and has made some curious verbal alterations. The name *absynthiata* must, I think, be struck off our lists.

Eup. scriptaria, Herr. Sch., Schm. Eur., III, 121, 1847.—This is a mountain-loving species, said to have been found in Labrador, and for that reason is given a place on our list.

Three species recently described by me, namely, *E. regina, E. modesta* and *E. obumbrata*, are near allies of *scriptaria*, but I think quite distinct. I have a beautiful bred specimen from Switzerland in my cabinet, and should not have any difficulty in recognizing the species should it turn up in any of our northern localities.

Eup. coagulata, Guenée, Spec. Gen., X, 339, 1857.—This species is stated by Packard to be the same as his *E. geminata*, and both are sunk in the Monograph as synonyms of *absynthiata.*

If I am correct in what I have said above as to *absynthiata*, it will follow, I think, that *coagulata* must stand for some American form very near to but distinct from that species. Guenée was familiar, of course, with the true *absynthiata*, and could see the differences existing in the American form, and he has pointed out some of them in his descriptions.

It seems to me most probable that Guenée had before him a specimen of the smaller of the two forms which Packard confused under the name of *geminata.* This is that figured in the Monograph on Plate viii, fig. 2. The only objection to this use of the name seems to be that this form lacks the *reddish* tinge which *coagulata* is said to possess. There is, however, in British Columbia a form which is quite red enough to satisfy the description, and though it is not likely that Guenée's type, said to be from Pennsylvania, could have been a western specimen, it is probable that it was conspecific. I have used the name *coagulata* for the western form, and I now use it also for the eastern, though not absolutely sure that I am correct. It is just possible that still another form may be found in

Pennsylvania which will be better entitled to the name, and in that case the present species will want a new name.

It has been suggested that the European *E. assimilata* and *E. expallidata* might occur here, but I am familiar with these two species, and they are certainly distinct from the one under consideration.

E. coagulata as here determined does not seem to be very abundant, though widely distributed.

My eastern specimens are all dated June. I have one from the Catskill Mountains (June 3, 1899). It is species No. 10 of a series, kindly sent me some time ago by Mr. R. F. Pearsall. I have it also from Montreal, Ottawa and a number of other localities.

Eup. gelidata, Möschler, Wien. Ent. Monats., IV, 47, 1860.—This species is placed on our lists on account of its occurrence in Labrador. According to Staudinger and Rebel (No. 3634), it also occurs in Greenland and the Shetland Islands. I have not seen it.

It is said by the last named authors to be a variety of *E. nanata*, Hubner, a common European (and British) species feeding on *Erica* and *Calluna*. *E. nanata* is a *Eupithecia*, but Hulst places *gelidata* in *Eucymatoge*, relying on the supposed difference in number of accessory cells, or more likely making a mistake through not having had specimens for critical examination.

The original description of *E. gelidata* is copied in the Monograph on pages 64 and 65.

Eup. hyperboreata, Staudinger, Stett. Ent. Zeit., 400, 1861.—Another northern species that I have never seen. Apparently it is nearly allied to the last named. The localities given in Staudinger and Rebel's Catalogue (No. 3635) are Norway, North Germany, Russia and Greenland.

Eup. anticaria, Walker, Cat. Lep. Het., Br. Mus., XXIV, 1241, 1862.—If it should turn out that the number of the accessory cells is a constant character in this genus, then *anticaria* will have to be placed in *Eucymatoge*, for it certainly possesses the two cells. Walker described this species and *implicata* and *explanata* all from Nova Scotia specimens, from the collection of Lieutenant Redman.

It seems to me probable that the three constitute but one species. The description of *anticaria* comes first in Walker's work, and it certainly applies to the common form which goes under that name in our collections, and which occurs almost everywhere, from the Atlantic to the Pacific.

Various attempts have been made by Hulst and others to identify *implicata* as something different to *anticaria*, but so far I have failed to find any form to fit the description better than does the ordinary *anticaria*.

Eup. miserulata, Grote, Proc. Ent. Soc. Phila., II, 32, 1863.—The type of this species is apparently lost. Packard, who had seen the type, placed his *interruptofasciata* as a synonym, but expresses some doubts as to the correctness of this course (see Monograph, p. 5*4), and I think that anyone reading the two descriptions carefully will agree that they refer to different insects. I believe I have correctly identified Grote's species. In the Packard collection, so Mr. Swett informs me, there is a specimen from the State of Virginia, whence the type came, which agrees exactly with specimens that I had named *miserulata* after a careful study of the descriptions. There are, however, in the Hulst and some other collections specimens of a different species which were sent out by Grote himself as *miserulata*. But it must be noted that Grote said that the only eastern *Eupithecia* known to him was this species. This being the case, it is clear that he could hardly be depended upon to accurately determine specimens in this genus, and I don't think that we should attach much weight to specimens sent out by him—some of them many years after the original specimen had been described, and which do not agree with the description.

Several different species are usually confused together under this name in collections, but the real thing is a rare insect and seldom found correctly identified.

The larva has been described more than once, but it is very doubtful whether any of the descriptions really apply to true *miserulata*. It will be better to ignore them all.

My specimens of this species are from Mr. R. F. Pearsall (No. 2), Bronx, April, 1904, and from Mr. H. D. Merrick, New Brighton, Pa., also taken in April. It seems to be rare.

The species may be easily recognized by the *linear* black discal and the very straight hind margins to the fore wings. (See note in CAN. ENT., XXXVII, 262.)

Von Gumppenberg described a variety *Californiata*, but it is in the highest degree unlikely that any variety of *miserulata* should occur in California.

(To be continued.)

NOTES ON CHRYSOPHANUS HYPOPHLÆAS AND ITS ALLIES, WITH DESCRIPTION OF A NEW SPECIES.

BY F. H. WOLLEY DOD, MILLARVILLE, ALBERTA.

Chrysophanus arethusa, n. sp.—Antennæ black and white-ringed, clubs black above, white, black-tipped beneath. Palpi brown above, whitish at sides and beneath. Eyes ringed with white. Head and thorax dark brown. Abdomen dark brown above, whitish or cinereous beneath.

♂.—Primaries sharply acute at the apices, the outer margin almost straight. Dark smoky-brown, with a handsome bronze lustre, overlaying and sometimes almost completely obscuring a shining fulvous ground, which is most evident in the cell and outer central portion of the wing. In only one out of five specimens is there a well-defined brown outer marginal border. A large rectangular black discal spot on the cross vein at end of cell, a smaller one in the centre of cell, and sometimes a third, smaller and ill-defined, near the base. A transverse row of six interspaceal black spots beyond the cell, varying much in size and distinctness; the upper three, the next two, and the sixth (geminate) in sets obliquely towards anal angle. Secondaries dull fuscous-brown, with a broad fulvous marginal band from anal angle to about two-thirds of the way to apex. A narrow black discal spot, and sometimes a black point in cell. An indistinct transverse row of small black spots just beyond the cell, another of larger spots on the inner edge of the fulvous band, and between these rows is sometimes a series of from two to five irregular metallic blue points. A marginal row of five black spots within the band. Fringes pale fuscous. Beneath, primaries pale yellowish-fulvous, apices and inner and outer margins cinereous. The spots of the upper side reproduced, but more clearly defined, and most of them pale-ringed, and a small sub-basal one in cell present in all the specimens. A transverse submarginal row of irregular blackish blotches in lower half of wing. Secondaries cinereous, with sometimes a faint line or discal mark, and sub-basal, intermedial and postmedial transverse rows of minute brown or blackish points, rarely all distinct, and in most specimens partially obsolete. Sometimes some small paler dashes exterior to the outer row. A very faint orange-red, crenate submarginal line, narrow, sometimes edged anteriorly with ochreous. Fringes almost concolorous.

♀.—Primaries with apices less acute, and outer margin more convex

than in the ♂, with much less of the brown suffusion, but a well-defined brown outer marginal band, and costal area somewhat broadly brown.

Expanse: ♂ 30–35 mm., ♀ 29–33 mm.

Described from five males and eight females. One male from the foothills, "Lineham's lower log camp, south fork of Sheep Creek," about thirty-five miles south-west of Calgary. All the rest from near the spruce woods about ten or fifteen miles nearer Calgary, July 5th–20th, all but three of the males quite fresh, though one broken in the mail. Types, ♂ and ♀ in U. S. National Museum, the rest co-types. Of these a pair are in the collection of the Entomological Society of Ontario, another pair in that of Dr. Henry Skinner, and the rest in that of the author. Dr. Fletcher and Dr. Holland each have a few specimens. I know of no others.

This may be looked upon as the Rocky Mountain representative of *hypophlæas*, from which it shows some striking differences, particularly in the male sex. It is larger, has more acute apices, and straighter outer margin. The shining bronze of the dark smoky suffusion, which generally obliterates the marginal band, renders some of the males far more handsome than any of the long series of its allies that I have from this continent, Europe or Asia. Beneath it differs in the strong tendency towards obsolescence of the spots and orange submarginal line on secondaries. In the absence of any widely-accepted definition of what a "species" really is, from its well-marked form and apparently isolated position on the entomologically-explored portion of North America, it is at least as deserving of a specific name as a large number of well-known forms on our lists. It has, however, some much nearer allies in some of the so-called forms of *phlæas* that I have from the Himalayas and from Syria under the names of *eleus* and *stygianus*, which, according to the Staudinger Catalogue, refer to the same form, and occur throughout the south palearctic region. And were I treating of the butterflies of the world, in which a tendency to lump would be scarcely avoidable, I should have left the Calgary form undescribed, and probably followed European authors in treating our common eastern species as a varietal form of *phlæas*.

Hypophlæas was described by Boisduval in a French journal from North American specimens by comparison with *phlæas*. A translation is: "Very near *phlæas*, but smaller, with the spots more distinct, the wings more rounded. The under side of secondaries of an ashy whiteness, with the fulvous marginal band well marked. North of California. It is found

in all the Northern United States." I have been unable to procure specimens from further west than Ontario or Illinois. In the Staudinger Catalogue, Lapland, Northern Scandinavia, Sajan-Geibet (Siberia), Amur and North America are quoted as localities for "var. *hypophlæas*," and some that I have bearing labels of some of those Old World localities would pass anywhere as North American specimens, amongst which there is also an occasional tendency to lose the spots, and so assimilate the typical European form. Besides having more pointed wings, the majority of my European and Asiatic specimens show a more decided tendency to develop tails in the secondaries than either the old or new forms of our continent; and it is a fact well worthy of observation that in some, though not all, of those most closely resembling ours in other respects, this tendency is least. *Hypophlæas* is recorded by Capt. Gamble Geddes as occurring in the region of the Crow's Nest Pass, in Southern Alberta. Dr. Fletcher tells me that if any such specimens were preserved they should be in the Geddes collection at Ottawa, but that he is unable to find any. With one or two small females only to hand, if the spots were unusually well developed, *arethusa* might have been passed as *hypophlæas* even by one well acquainted with that species without comment. The name I have chosen is purely fanciful.

GEOMETRID NOTES—No. 2.

BY RICHARD F. PEARSALL, BROOKLYN, N. Y.

In 1873 Dr. Packard described a species (5th Rep. Peabody Acad. Sci., 1878) under the name of *Cleora pellucidaria*, having before him two males, one from Maine (Pack.) and the other Albany (Lintner). If my memory serves me correctly, I saw the Maine specimen when at Cambridge in going over his collection. Shortly afterward, through the kindness of Mr. D. H. Haight, I received a female of the same species, taken near his home at Copper Cliff, Ont., Sept. 9, '04, and, in a recent visit to Albany, N. Y., found in the Lintner coll. the original co-type described by Dr. Packard, bearing a label in his handwriting. In the Monograph, page 453, he refers to this species, having a doubt at that time of its validity. The species is a good one, and differs from *semiclusaria*, Walk., by its larger size, stouter build, its uniform soft gray colour, and by having the front a darker smoky hue, while in *semiclusaria*

the front is white or pale yellow, as also are the patagia at their bases. It belongs to the genus Nepytia, Hlst, and seems to be rare. Dr. Strecker (Lep. Rhop. Het. Suppl., 2, 1899) has described as *Cleora fumosaria* a species which I take to be the same, although I have not seen his type, but Dr. Packard's name has priority.

That Dr. Packard had not always a correct eye for species, Mr. Taylor has recently pointed out (CAN. ENT., Vol. 38, p. 403) where he separates from *Cleora umbrosaria*, Pack., a species generically distinct under the name of *Enypia Packardata*, Taylor, and quite correctly, calling attention to the error in the plate (Mono. Plate xi, fig. 33) as to the pectinate antennæ. I will go yet further. Referring to my notes and drawings taken when at Cambridge, I find that three specimens were placed under *Cleora umbrosaria*, the first one, a ♂, was without antennæ, but my note reads: " the stubs surely indicate simple antennæ"; this is *Packardata*, Taylor. The next one was a ♂, *pellucidaria* or large *semiclusaria*, in bad condition, without body or legs, and only *one* pectinate antenna, also without label of any kind; the third clearly a ♀ of *Enypia venata*, Grote. It seems clear to me that, supposing them all to be the same, the plate of the first one was supplied with antennæ to correspond with those of the second, hence the error.

After my trip to Albany, I discovered it to have been Dr. Packard's custom to return his types when described to their original owners, and since *Cleora umbrosaria* was described originally from a single ♂ taken in California by Hy. Edwards, I visited the Am. Mus. of Nat. History, N. Y., into whose possession his collection passed, in the hope of finding it. There I discovered a single ♂ specimen bearing an old No. 183, and labeled " California," and a new one, "No. 12963, Coll. of Hy. Edwards."

It answers in every particular to the excellent description of Dr. Packard, and there is not the slightest doubt in my mind that it is the type, but it proves to be a rather dark, well-covered ♂ of the species afterwards described by Packard (Mono., page 454) as *Cleora nigrovenaria*, having the extra-discal line heavier and the black dashes on the veins less numerous, though they are present. Of course it has the " heavily pectinate antennæ " he especially notes.

The female (Mono. Plate xi., fig. 35), to which he refers on page 453 as unknown to him, is an excellent figure of *Spodolepis substriataria*, described some years later by Dr. Hulst.

A NEW TREE CRICKET FROM STATEN ISLAND AND NEW JERSEY.

BY WILLIAM T. DAVIS, NEW BRIGHTON, STATEN ISLAND, N. Y.

In my collection of tree crickets there is a species collected on Staten Island and at Cranford, Manasquan and Farmingdale, in New Jersey, that appears to be undescribed. It resembles *Œcanthus angustipennis*, Fitch, more than any of the other native species, but may be easily distinguished from it by its larger size, the marks on the first and second antennal joints, which taken together resemble an exclamation point, and by the absence of any clouded area on the top of the prothorax. My attention was first drawn to the species by collecting three examples together on Long Neck, Staten Island, and later I found that I had some others. It has not so far been found at Lakehurst, in the pine barrens of New Jersey, where *Œ. angustipennis* is common.

Figure 7 shows the elevated black marks on the under side of the first and second antennal joints of *angustipennis*, while Fig. 8 represents the marks as they occur in the new species, which may be more particularly characterized as follows:

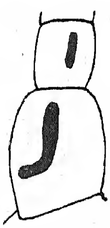


FIG. 7.

FIG. 8.

Œcanthus exclamationis, n. sp. — Pale greenish-white, including the upper surface of the prothorax, with the top of the head occasionally a little darker. Antennæ each with two elevated black marks on the under side; the one on the first joint shaped like the upper part of an ! point. The mark on the second joint is oblong. Average length from the head to the tip of wing-covers 17 mm.; body, 12 mm.; ovipositor, 5 mm.; width of male tegmina, 5 mm.

Dr. Fitch, in 1856, mentions the black marks on the under side of the antennæ of tree crickets, and in his description of *Œ. niveus*, De Geer, he notes six varieties, three of which he names. One of these is the species *Œ. angustipennis*, Fitch, as now considered by authors; his var. "a" seems to be the new species above mentioned; "b" is probably Mr. Beutenmuller's *pini*, or possibly an example of his own *fasciatus*, and "c" is no doubt *Œ. quadripunctatus*, Beut. The other two ("e," *discoloratus*,

and "f," *fucipes*) cannot be placed, but "f" is likely also a dark-coloured example of *fasciatus*.

Another interesting tree cricket is a form kindly given me by Mr. Charles Schæffer, and collected by him at Brownsville, Texas, and in Southern Arizona. It is of the same size as *Œ. latipennis*, Riley, and the head, as in that species, is also coloured pink, but in all but two examples examined there is a single narrow black line on each of the first two antennal joints. These two joints are light-coloured, and are generally pink; the succeeding ten or twelve are black, and the remainder gradually shade off and are of a lighter hue. This insect appears to be *Œ. varicornis*, Walker, an addition to the fauna of the United States, as it was originally described from Mexico. Walker characterizes the insect as having the fore wings very broad and the antennæ "black towards the base, testaceous at the base." He further adds: "The colour of the antennæ and the broader fore wings distinguish this species from *Œ. niveus*."

BOOK NOTICES.

Anatomical Terminology.—With vocabularies in Latin and English, and illustrations by L. F. Barker, M.D., Philadelphia: Blakiston's Sons & Co. 8 vo., pp. 102. (Price $1.00.)

Teachers and students alike of anatomy feel that the existing status of scientific nomenclature leaves much to be desired. Terms are dissimilar in construction, and often unnecessarily long, so that it is a matter of extreme difficulty to acquire familiarity with them. Even more of a grievance is the unfortunate multiplicity of terms applied to one and the same part. Each text-book must burden the reader with synonymous names for many parts, or leave its references uncertain to all who know those parts under other names than the ones used.

That this very real hindrance under which science labours is not insurmountable was the conviction with which the German Anatomical Society, an association of international scope and high repute, undertook the enterprise which resulted in the publication in 1895, after six years of labour, of the B. N. A. (Basle Anatomical Nomenclature). This Associa-

tion appointed a commission of notable scientists from several countries to compile from the many thousands of terms in use, as applied to microscopical human anatomy, a list which should include only the term for each part which was decided to be most suitable. This commission set to work on the difficult and exacting task in hand, guided by certain principles to which they were able to adhere with but few digressions. The aims of the undertaking can be best made clear by quoting Prof. Barker's own statement of these principles :

"(1) Each part shall have only one name.

(2) Each term shall be in Latin, and shall be philologically correct.

(3) Each term shall be as short and simple as possible.

(4) The terms shall be merely memory signs, and need lay no claim to description or to speculative interpretation.

(5) Related terms shall as far as possible be similar, e.g., Femur, Arteria femoralis, Vena femoralis, Nervus femoralis.

(6) Adjectives in general shall be arranged as opposites, e.g., dexter and sinister; major and minor; anterior and posterior; superficialis and profundus."

The result of these labours was a systematized and selected list of Latin terms, which can be used in any country, either through a translation or, better even, in the Latin form. It has been adopted as a basis of nomenclature in Europe to a large extent; and in Great Britain and America has been employed in various medical schools and treatises on anatomical subjects with apparently good success. The publication of Prof. Barker's book from the press of P. Blakiston's Sons & Co., in which both Latin and an Anglicized list are presented, should do much to further the general adoption of the B. N. A.

The general introduction of this list into the educational work of American institutions would, it is hoped, greatly facilitate research and progress in anatomy, by removing the unnecessary part of a most unscientific collection of technical terms, as 5,000 accepted names would serve the purpose, for which there are now many times that number in use.—T. D. Jarvis.

TOWER'S EVOLUTION IN LEPTINOTARSA.

BY FRANK E. LUTZ, COLD SPRING HARBOR, N. Y.

One of the most important of the recent studies of evolution, and probably *the* most important of the purely entomological works on this subject, is Wm. D. Tower's "Investigation of Evolution in the Chrysomelid Beetles of the Genus Leptinotarsa."* "In this contribution have been brought together data concerning evolution in the genus *Leptinotarsa*, Stal, as gathered from various sources [during 11 years], and in as far as it applies to the origin of species. In general, the evidence herein presented has been derived from three sources: (1) its *natural history*, including distribution and œcology, variations, habits and instincts; (2) *development*; (3) *experiment*." It is the large number and thoroughness of the experiments which makes the work so valuable, and such a refreshing change from the numerous discussions of pin-stuck data that encumber but do not greatly elucidate the problems of evolution.

Chapter I is an interesting discussion of the geographical distribution of the genus. By the use of four of the criteria given by Adams (Biol. Bull., 1902), the centre of origin of the genus is found to be Southern Mexico. The other six criteria are rather severely criticised. If space permitted, these might be profitably discussed, as some of the criticisms do not seem to be fully justified. Valuable detailed data concerning the spread of the Colorado potato beetle are collected and given here.

Chapter II is a study of variation. A number of laws for the genus are deduced. Variation is found to be determinate. "In the elements of the colour pattern there is a tendency for the spots to spread out or contract peripherally, and the stripes and bands to extend or contract at their ends. The spots, stripes and bands are most variable in the posterior or distal portions of the structures on which they occur, and least variable in the anterior and proximal portions thereof. Increase of pigmentation or modification of colour pattern moves caudalward or distalward, while decrease moves cephalward or medianward." "Large or extreme variations are determinate, and always occur in directions corresponding to the maximum lines of fluctuating variations." "All variations of colour and structural characters are strongly correlated, ... so that causes which produce a variation in one part bring about either directly or indirectly corresponding variations in other parts."

*Carnegie Institution of Washington, Publication No. 48, Papers of the Station for Experimental Evolution No. 4.

A number of "extreme variates" are noted, which the author declines to call mutants, but in later discussions refers to as "mutants." It seems to me the quotation marks might well have been left off. The author maintains "that 'mutation' is not a special kind of variability different from that of 'ordinary fluctuating variation,' but it is a part of the normal variability, and the direct response of the germ plasm to stimuli." If I understand the case correctly, these "extreme variates" are quite extreme; they are rare, occurring only once in 6,000 cases; and *breed true*, a thing which ordinary variates do not do. This is my idea of a mutant. The mere question of terms, however, is relatively unimportant. The fact is, Tower has given us one of the strongest arguments for the importance of mutations that has ever been presented, although he seems to think otherwise. He says: "The breeding 'mutants' in our gardens and laboratories can not tell us how they would succeed in nature; my experience with these beetles is that they fare badly, and, as far as I can discover, that they play a minor role in the evolution of species." However, he had already stated (p. 273 *et seq.*) that not only did *pallida*, one of the "mutants," breed absolutely true for six generations in the laboratory with "no tendency to revert to the parental species" *(decemlineata)*, but that from 14 males and 15 females allowed to shift for themselves in nature, 1,580 *pallida* offspring of the 6th generation were found, and he "felt that further experiment with this form unconfined in nature was neither safe nor desirable, and exterminated the entire lot." It is true that 29 *pallida* is more than he ever found in nature at one time and place, but he did find 6 at Clifton, Ohio, and he noted that occasionally, as at Cabin John Bridge, Md., in 1900, sports are relatively very abundant. *Pallida* is only one of a number of similar cases that Tower found. If I had been so fortunate as to obtain his results I would have drawn quite the opposite conclusions, and would have supported the mutation theory most loyally, believing it to be the statement of one, at least, method of evolution.

But the cream of Tower's paper has not yet been noted. After discussing (Chap. III) the ontogeny, chemistry, etc., of coloration in Leptinotarsa, and showing that marked colour variations can be brought about by varying the environmental conditions during development, but that *these variations are not inherited;* and after treating of habits, assortative mating, etc., in Chapter IV, he shows in Chapter V how *inheritable variations can be brought about artificially.* Selection alone is apparently

impotent to create new races until an individual, no different externally from the others, is found whose offspring do not revert as do offspring in general. However, if, after a female, for instance, has attained her final form and coloration, she be subjected to extreme temperature and moisture conditions, the germ plasm of the eggs then maturing is so affected that the beetles developing from them are, for the most part, entirely different from the parent form, even though their entire ontogeny is passed under perfectly normal conditions, and they will breed true, under normal conditions, to their new characters. If this same original female had been returned to a normal environment the eggs which mature under these conditions develop into normal offspring as though their mother had never been forced to give birth to abnormal children. To quote part of a single experiment :

"In May, 1901, I subjected four males and four females from the hibernating population of *decemlineata* to extremely hot (average 35° C.), dry (relative humidity, average 45 per cent.) conditions, accompanied by low atmospheric pressure (19–21 inches) during the growth and fertilization of the first three lots of eggs, which were placed as soon as laid in natural conditions and reared. The last two lots were laid and reared in normal conditions. The first I designated Lot A, the second Lot B. All were reared during their ontogeny from the earliest embryonic stage to adults in normal environment. From 506 larvæ which hatched from Lot A I obtained 96 adult beetles, of which 82 were of the form *pallida*, two of the form *immaculo-thorax*, and 14 unmodified. From Lot B, of 319 eggs I got 61 normal beetles."

In another experiment the action of abnormal conditions on the forming germ plasm brought about inheritable physiological modifications. They had five instead of two or three generations a year, being normal in every other respect. This was kept up through three cycles, when the experiment was stopped. "In the rise of a *five-brooded race* there was a pure, perfectly constant inheritable character arising as the response to stimuli applied to the germ plasm. Eleven years of study of this and related genera have shown that *in none of the family, or relations of the family, are there traces of five-brooded races or species.*"

Unfortunately, further details of the data can not be given here. But an idea of the contents of the paper has perhaps been given. Not even all the conclusions can be quoted. The following, however, can not be passed over : "Variation is to be interpreted upon the basis of response to stimuli directed by the stage of development reached and the nature of the pre-existing stages. Variation is also epigenetic, and not a pre-determined character in organisms" (p. 307). "There is not at present

evidence to show the origin of any heritable variations in the soma. Moreover, I have shown that in these beetles we can get new permanent variations by stimulating the germ cells, and in no other way" (p. 311). "I am . . . . of the opinion that the evolution of the genus Leptinotarsa, and of animals in general, has been continuous and direct, developing new species in migrating races by direct response to the conditions of existence. In this evolution natural selection has acted to determine antecedent states and the persistence of new variations, but in each race or species it acts as the conservator of the race, keeping down extreme variations through their elimination in hibernation, larval life and selective mating."

UNITED STATES GOVERNMENT APPROPRIATIONS FOR ENTOMOLOGICAL PURPOSES FOR THE FISCAL YEAR ENDING JUNE 30, 1908.

Bureau of Entomology, Washington	$136,010 00
Emergency appropriations:	
Cotton-boll Weevil investigations	190,000 00
Prevention of spread of Gypsy and Brown-tail Moths	150,000 00
Eradication Cattle Ticks	150,000 00
	$626,010 00

There is also an appropriation of $250,080 for the National Museum, a portion of which will be applied to the Collections of Insects. The expense of printing bulletins, etc., for the Scientific Bureaus is covered by a further appropriation of $824,450.

In the statement of expenditures at the end of the Report of the Experimental Farms of the Dominion of Canada for the year ending June, 1905 (the last we have access to), there is to be found the following item:

"Entomological and Botanical Division, including salaries of officers in charge ..$4,265 38"

This amount may possibly have been increased to $5,000 for the current year.

Dr. Howard has a staff of more than seventy-five men, and considerably over half a million of dollars at his disposal.

Dr. Fletcher has two assistants and five thousand dollars, with nearly as large a territory to cover, and is expected to include botany as well as entomology in his sphere of work. Is not this a disgrace to the Dominion?

ACKNOWLEDGMENTS.

The Curator begs to acknowledge, with grateful thanks, the gift to the Entomological Society of Ontario of a large collection of Canadian and exotic Coleoptera, which are a welcome and valuable addition to the cabinets. The native specimens will be used to fill up blanks and replace imperfect examples in the collections, and will assist very materially in rendering more complete the Society's representation of the insects of the Dominion. Thanks are due to Mr. Henry S. Saunders, of Toronto, for this generous gift.

He also thankfully acknowledges the receipt of a pair of co-types of *Chrysophanus arethusa*, new species, from Mr. Wolley Dod, of Millarville, Alberta. This form is described on page 169 above.

A NEW GEOMETRID.

BY WM. H. BROADWELL, NEWARK, N. J.

Cleora areataria, n. sp.—Type, 1 ♀. Antennæ filiform. Body and wings whitish-gray. Fore wings with three conspicuous, sinuous lines, discal dot faint. T. a. line beginning one-third outward on costa, rounded outwardly and denticulate, inner edge bordered with dark gray; a white patch at base. Middle of wings light gray, almost white, with a faint line running from lower margin to just below discal dot, then rounding outward to just below discal dot, and back to costa, where it ends in a conspicuous black elongated mark.

T. p. line black and bent outward at middle of wings, then inward to costa; between that and outer edge a white denticulate line of same shape as t. p. line. A marginal row of black dots at ends of veins. Area from t. p. line to outer edge dark gray. Fringe checkered white and gray. Lower wings with a faint trace of the inner line.

Beneath pale whitish-gray. T. p. line showing on both wings. Discal dot large, prominent and with a white centre. Discal dot on lower wings smaller, black and solid.

Legs dark gray. Fore legs darker and banded, white and black.

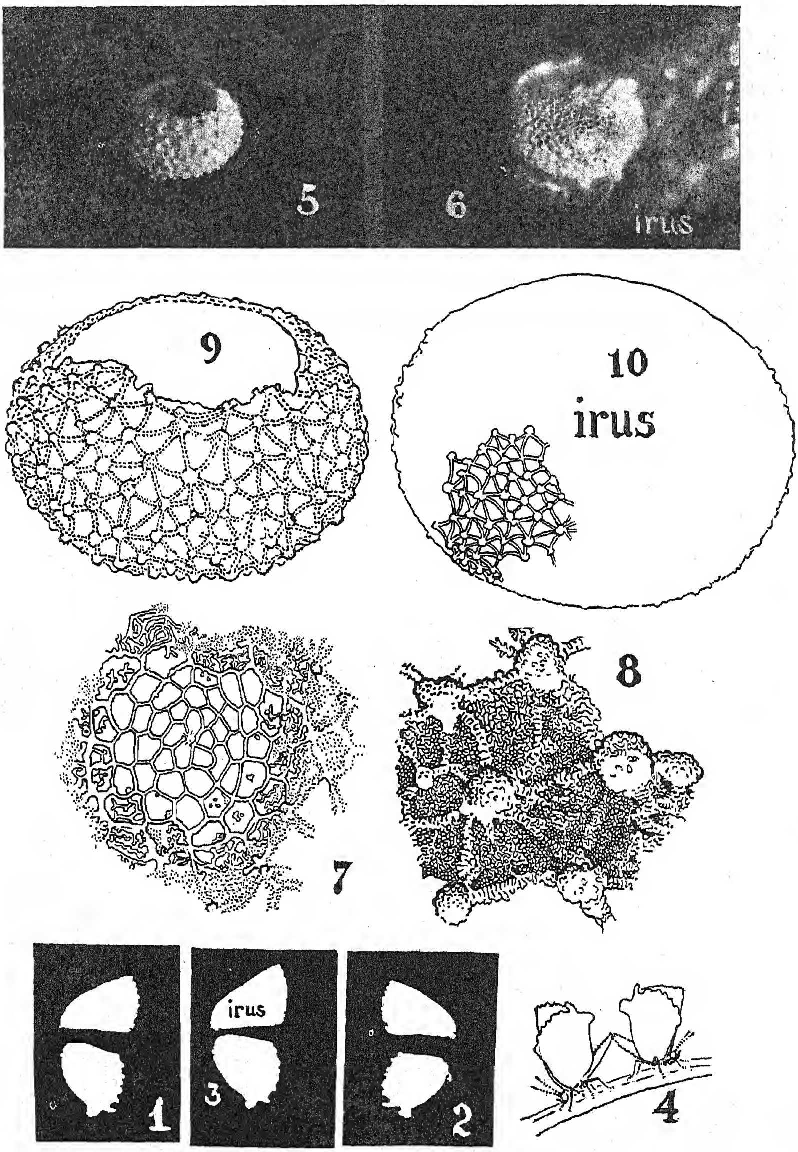
Length of body, 11 mm.; of fore wings, 15 mm.; expanse, 30 mm.

This species may be known by the broad light-coloured band in middle of wings, and white patch at base, equalling about one-half the area of fore wings. It is almost a replica of *C. atrolinearia*, Hulst, but smaller, and lacking the general brown cast bordering the lines of that species.

Locality, Hemlock Falls, South Orange, N. J., April 22nd.

NOTE.—Photo of *C. areataria* can be had by applying to me.

Mailed May 4th, 1907.



INCISALIA HENRICI, GROTE AND ROBINSON.

The Canadian Entomologist.

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STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

III.—INCISALIA HENRICI.

Previous Paper.—In the CANADIAN ENTOMOLOGIST for June, 1905 (Vol. XXXVII, No. 6, p. 216), I published an article in which I pointed out the more obvious differences which serve to distinguish this species from *I. irus*, with which it has been confused. In addition to the characters supplied by the coloration of the wings, I mentioned that the male *Henrici* has no discal stigma,* a fact which seems to have been overlooked by other observers. I stated further that this furnished a reliable diagnostic character for the identification of the species, and, inasmuch as *irus* males invariably have the stigma, the specific validity of *Henrici* should be recognized "at least until the test of breeding could be applied." Being, at the time, unacquainted with the life-history of either species, and being unwilling to express hasty and possibly premature conclusions, I did not feel wholly warranted in holding that W. H. Edwards was right and Dr. Scudder wrong in their respective opinions concerning the butterfly bred by the former. Edwards described the early stages as those of *Henrici*, but Scudder, not recognizing *Henrici* as a species, applied them *(all excepting the egg)* to *irus*. I took the ground that we were justified in withholding judgment in the matter until further facts were discovered. Since there did not appear to be any strong probability that another would supply me with the necessary facts, I set about getting them for myself. Having succeeded in breeding both species side by side, from egg to imago, both parents being known in each case, I can now state positively that Edwards bred *Henrici* (as he stated) and not *irus*, and that his descriptions of the early stages are correct to the minutest detail. Moreover, Scudder was in error in quoting the descriptions of the larval and pupal instars under the caption *irus*. The two species differ so

*In his "Bibliography of Canadian Entomology for the year 1905." Dr. C. J. S. Bethune has credited me with having stated that "*some* males . . . . are without the characteristic stigma." A careful reading of the article will, I think, make it apparent that the statement was intended to cover *all* the males.

markedly as eggs, caterpillars and chrysalids, that a schoolboy collector could not fail to separate them properly.

The Type.—This species was first described by Grote and Robinson in 1867 (Trans. Am. Ent. Soc., I, 174), and the type specimen is now in the collection of the American Museum of Natural History in New York City. After a careful comparison with the butterflies in my own collection, I have no hesitation in affirming that *it is a male*,* although, the abdomen having been lost, positive determination is impossible.

An Error Corrected.—In his Catalogue of Butterflies (1878) Strecker places *Henrici* as variety b of *irus*, and adds: "Smaller. Inferiors tailless." Since this characterization is altogether misleading, I have thought it worth while to direct attention to the error. It is true that averages made from a large number of specimens will show that *Henrici* is a trifle the smaller, but many of the larger *Henrici* have a broader alar expanse than the majority of *irus*, so the knowledge of averages is not of much assistance to the collector. As for the statement that the secondaries of *Henrici* are without tails, and the implication that tails are always to be found in *irus*, I can only say that such is not the case. In this respect *irus* is variable, occasional specimens (bred) appearing from chrysalis, with merely a slight projection at the end of the nervule as in *niphon*; again, though more rarely, the tails are quite pronounced. Fig. 3 (Plate 4) represents the outline of *irus* wings usually met with; fig. 1 is the male and fig. 2 the female of *Henrici*, showing that well-developed tails are present in both sexes.† Of this species no individuals with tailless inferiors have come to my attention except where the tails have obviously been lost.

Time of Flight.—Species single-brooded, the butterflies appearing with *irus*; *i. e.*, at the very end of April. Never so abundant (here) as the latter, and to be sought with greatest success in sunny spots in the open pine woods, where *Vaccinium vacillans* is the dominant shrub of the undergrowth, and around the edges of swamps where *V. corymbosum* is to be found. Its season of greatest abundance and time of disappearance

*My determination is based principally on the fact that the type is marked with red-brown near the anal angle of the secondaries above, while the primaries are not suffused. In my series of nearly 200 butterflies this combination is found only in the males, the females showing more or less suffusion on all the wings, and when this is reduced on the primaries it is about equally reduced on the secondaries, never remaining, as in the males, a rather conspicuous patch near the angle.

†These figures, natural size, are from blue prints made directly from the insects' wings.

appear to be the same as the corresponding seasons of *irus*, the butterflies rarely enduring into June. From the observations of W. H. Edwards, it is evident that the species is flying in West Virginia nearly a month before it appears at Albany.

Securing the Eggs.—Edwards was led to imprison a female over wild plum (*Prunus Americana ?*) by having once discovered an unknown *Lycænid* larva boring into the fruit of that plant. He secured eggs. Since there are no plums, wild or cultivated, on the uninviting and almost uninhabited pine-barrens where *Henrici* is most abundant in this region, the local food-plant had to be determined.

During the spring of 1905 every female captured was confined over plum and *Lupinus perennis* (the food-plant of *irus*), but no eggs were laid. About noon on the 28th of May a worn specimen was observed flying weakly among the low shrubbery, and in the hope that it might prove to be a fertile female I followed it. Several times during the afternoon the insect alighted on *Vaccinium vacillans*, curled its abdomen and pressed the tip against some part of the plant, usually a bud, but no eggs were extruded. This and another fresh-looking female taken on the 24th were then confined over *vacillans*. The next day both were dead. Dissection showed that the abdomen of the worn butterfly contained a single egg, while that of the other contained fourteen. The ova were very soft, and it was impossible to determine more than that they differed considerably from *irus* eggs.

Henrici first appeared in 1906, on the 28th of April, and on the 7th of May I had the good fortune to disturb a pair *in copulo*. The flight was short, and the insects alighted on one of a number of long straws lying among the dry persistent stems of a clump of *Ceanothus* in such a position that it was not advisable to risk an attempt to cover them with the net. The posture of the butterflies during *coitus* merits attention, as it doubtless explains or is explained by the peculiar modification of the genitalia found in the Theclidi. I have witnessed the *coitus* of all our local Chrysophanidi and Lycænidi, and in every instance the abdomens of the copulating insects were held approximately in the same line; these butterflies held their abdomens high so that they formed an angle of about ninety degrees, as illustrated in the plate (fig. 4). The wings were closely appressed, the secondaries lifted away from the body, and the primaries dropped backward between them so that, except for the projecting apices, they were completely hidden. Whenever the female moved forward even

a little the male would immediately back up until the position described was regained, acting as though any other position was painful, or at least uncomfortable.

I began cautiously to cut away the branches which would prevent my net rim from reaching the ground, intending to lower the bag over the pair so carefully that they would not take alarm and separate, and then to sit quietly by until copulation was finished, or, if necessary, to leave them undisturbed overnight. I had succeeded in clearing away the inconvenient branches without frightening the butterflies, and had just laid hold of the net when my plans were suddenly upset by the male, who released the body of the female and flew to a dead twig a few yards away. This happened at 10.40 a.m., exactly ten minutes after I first sighted the pair. It was then an easy matter to capture the insects. Not being confident of the sex of either, I brought both to the laboratory alive, and after noting such differences as appeared on the visible wing surfaces, I put them together in a cage over a growing plant of *vacillans*.* On the 13th one of the butterflies died; it proved to be the male. About noon on the 15th I examined the plant with a lens without finding any eggs. Shortly before two o'clock I transferred the female to a cage containing twigs of plum (cultivated), *V. corymbosum*, *V. vacillans* and *V. pennsylvanicum*, and on looking over the plant from which she had been removed, I discovered an egg on the outside of one of the opening leaf-buds. I straightway turned my attention to the imprisoned butterfly.

Oviposition.—Observation began at 1.57 p.m., at which time she was resting quietly on the gauze. Four minutes later she began to walk about nervously, and at 2.05 dropped to a spray of *vacillans*, and almost immediately oviposited on the outer scale of an unopened bud. A few seconds afterward she returned to the gauze, but continued to move about actively as though seeking a way of escape. At 2.07 she again dropped to the plants, this time alighting on a plum leaf, from which she walked up the stem and over the flowers, jumped to an open flower of *vacillans*, and, with more deliberation than before, oviposited on the calyx (2.08), returning shortly to the gauze. Wishing to determine the minimum interval between the laying of two eggs, I removed two of the four uprights which held the netting in position, and by bringing the butterfly close to the plants I was

*The weather for the next few days may be of interest, as it possibly influences to some extent the length of time elapsing between *coitus* and ovipositing. May 8th, 9th and 10th cold, cloudy, with rain at intervals; 11th fair but cold; 12th hazy, with keen wind, rain in afternoon; 13th cold, rain; 14th fair and warm; 15th fair and warm.

able to induce her to walk on to them every thirty seconds. Six times she returned to the gauze immediately; at the seventh trial she oviposited (2.12) on *V. corymbosum* (calyx). The same course was followed again, and resulted in seven returns to the gauze, and an egg (2.16) on *vacillans* (corolla); then seven returns and another egg on *vacillans* (calyx). The butterfly then refused twenty successive invitations to oviposit, and upon being left undisturbed took up a position on the netting, concealing the primary wings as far as possible between the secondaries, which also hid the abdomen. This appeared to signify that the performance was ended, and, as my duties called me away, I made note of the location of each of the five eggs, and brought my observation to a close.

The growing plant oviposited upon between 11.40 a.m. and 1.40 p.m. was searched (as was also the box and netting), with the result that seven eggs, besides the one first noticed, were found as follows: terminal leaf-bud of longer stem, 4 (2 at base of inner leaf, on lower surface; 2 close together at apex of outer leaf, on upper surface); terminal flower-bud of shorter stem, 2 (at base of cluster, on scales); next lower flower-bud, same stem, 1 (same position).

Two days later another confined female laid an unfertilized egg on the calyx of a *vacillans* flower, and this may be assumed to be the location usually selected when the buds are sufficiently open, otherwise the eggs are placed on the scales of flower-buds, and possibly also on those of leaf-buds.

Number of Eggs.—Edwards obtained fifteen eggs; my female yielded thirteen, and the butterfly dissected in 1905 contained fourteen.

The Egg.—In my discussion of *Incisalia irus* I stated* that the "only published account of the early stages of that species, *except Scudder's description and figures of the egg*" (and, I neglected to add, his description of the larva at birth, the figure of its head, and the *coloured* illustration of the chrysalis), was to be found in the work of Boisduval and Leconte. As I have pointed out, Scudder borrowed Edwards's descriptions of the other larval instars and of the pupa of *Henrici*, and applied them to *irus* under the impression that they were one and the same species. *He did not quote Edwards's description of the egg*, but gave his own, based undoubtedly upon personal examination.† There would be nothing

*Canadian Entomologist, Vol. XXXVIII, No. 6 (June, 1906), p. 181.

†Dr. Scudder says that he has "in two instances known eggs to be laid by females (*irus*) shut up in chip boxes." Presumably one or more of these furnished the basis of the description and figures.

remarkable in this were it not for the fact that *in one vital point Edwards's description does not correspond to Scudder's.* And yet the discrepancy is not mentioned, and was probably overlooked, though it was presumptive evidence of error. The solution is that *Scudder described and figured the egg of irus, while Edwards described the egg of Henrici.* To assist any who may be inclined to doubt the worth of my judgment in the matter, I have reproduced in the plate photomicrographs of the egg-shells of *irus* (fig. 6) and *Henrici* (fig. 5).* The shells are magnified equally.

Edwards† described the egg of *Henrici* as follows: "Shaped like that of *Lycæna pseudargiolus (Cyaniris ladon)*, and marked very much in the same manner; the top flattened, and at the micropyle depressed; about this last are three concentric rows of minute spaces, rhomboidal to irregularly pentagonal; the remainder of the surface is covered with a *frosted* network, the meshes of which are triangular, and from each angle rises a low rounded knob; colour whitish-green. . . . ."

Comparison with Irus Egg.—The value of a description is greater in proportion to the emphasis placed upon comparative characters, and although the egg of *Henrici* has a greater general resemblance to that of *niphon* than to either *augustus* or *irus*, I have, for obvious reasons, chosen to contrast it with the egg of the last-named species. The most striking difference between them is that the primary ornamentation (consisting, in both, of bosses connected by slightly raised ridges), which in *irus* is clear, unobscured and easily made out, is in *Henrici* covered and greatly obscured by a secondary ornamentation difficult to analyze, but rendering the shell nearly opaque, and giving the appearance described as "frosted" by Edwards (and by Scudder in his description of *niphon*). Under a moderate power the new-laid egg is green, flecked with minute white points where the irregular surface catches the light, and studded with large and prominent white bosses. New-laid *irus* eggs are of about the same shade of green, the smooth surface not catching points of light, studded with small, more numerous bosses not at all prominent. As the embryo larva develops, the green colour is lost, but in *irus* the colour of the caterpillar (yellowish) is visible through the transparent shell, while in *Henrici* this is

*Since the photomicrographs have unavoidably lost somewhat in being reproduced, I have made arrangements with the maker, Mr. Jas. A. Glenn, 65 North Pearl Street, Albany, N. Y., whereby any who may desire to do so can purchase prints from the negatives (slightly larger and showing detail more clearly) at ten cents each.

†Papilio, I, 150.

not the case, the whole surface appearing white and as though dusted over with microscopic grains of quartz. The bosses may be studied by reflected light; the primary reticulation is visible as dark but well-defined, clear-cut lines when viewed under a moderate power by transmitted light; and the secondary ornamentation can be satisfactorily made out in prepared sections only. Fig. 8 is a composite drawing made by combining the results of all three methods.

Other and more important differences are these: (1) *Henrici* eggs are smaller than *irus* eggs in the proportion of 8 to 9 (equatorial diameter), and yet (2) the "hexagons" (Scudder) formed by the roughly equilateral triangles of the reticulation are larger in *Henrici* in the proportion of 5 to 3, and (3) the bosses are in *Henrici* broader in the proportion of 2 to 1. These facts are brought out in fig. 9 (primary reticulation *Henrici*), and fig. 10 (outline *irus*, and part of reticulation*). Moreover (4), the reticulation of *Henrici* is far more regular than that of *irus*, which latter is often broken up by areas without or with greatly reduced bosses, and the "cells" (Scudder) not arranged in hexagons. Compare figs. 5 and 6. Again (5) the "cells" of *Henrici* are sunken so that the lines connecting the bosses are bowed inward, giving each boss the appearance of being raised on a rude pyramid. (6) In an *irus* egg the reticulation is continued (without bosses) over the bottom, while the bottom of the *Henrici* egg is nearly clear, transparent, and without reticulation. (7) The micropyle of *irus* is clear, and merges almost imperceptibly with the surrounding "cells."† That of *Henrici* (fig. 7) contains occasional refractive corpuscles (nobis), and is strongly demarked from the surrounding area by the rather ragged edge of the secondary ornamentation.

(To be continued.)

A FOSSIL CATERPILLAR.

BY T. D. A. COCKERELL, BOULDER, COLO.

Among the materials obtained in the summer of 1906 in the Miocene shales of Florissant, Colorado, is a beautifully-preserved caterpillar. It was collected by my wife at Station 14 (of Bull. Amer. Mus. Nat. Hist., 1907, p. 131). It appears to belong to a distinct genus, and may be characterized as follows:

*For a complete figure of *irus* egg see Scudder's Butterflies of the Eastern U. S. and Canada.

†Figured in Scudder's Butterflies of the Eastern U. S. and Canada, Plate 68, and in the CANADIAN ENTOMOLOGIST, Vol. XXXVIII, Plate 1 (May, 1906).

Phylledestes vorax, n. g., n. sp. (Fig. 9.)

Length, 27 mm.; with the general proportions of a Noctuid larva, the body fairly stout, cylindrical, with the usual legs and stigmata; head rounded, ordinary, not very large, its vertical length 3¾ mm.; body smooth, as preserved rather light reddish-brown, without spots or lines, but pallid ventrally; first body segment, in the anterior subdorsal region on each side, with a patch of six or seven minute round spots resembling ocelli, not bearing any hairs; no sign of a prothoracic plate; tubercles all absent (or not visible, though the skin is very well preserved, showing the spiracles, etc., clearly) except tubercle 1 (as I take it to be, since it is always directly above the spiracle), which is recognizable on body-segments 2 to 10 because it emits very stout bristles, those on segments 2 and 10 smaller and in bundles, of three on the former, two on the latter; the others large, stout and black, a single one on each side of each segment. This armature may be expressed by a formula, 0, 3, 1, 1, 1, 1, 1, 1, 1, 2, 0. The bristles, though very stout, and the longer ones about 3½ mm. long, are distinctly bristles, capable of bending, not spines; and they do not show the least spinulation or branching. The distance between the spiracles and the bases of the bristles is on the middle abdominal segments a little over 2 mm.

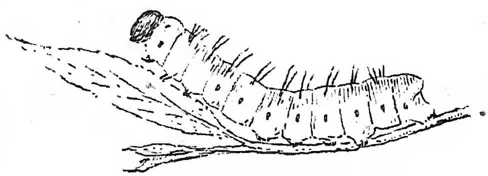


FIG. 9.—Fossil Caterpillar.

In the figure I have represented the caterpillar as walking on a twig, and have enlarged it, but have shown nothing that is not plainly visible in the fossil.

Scudder described eight species of butterflies from the Florissant shales, finding them all to belong to extinct genera. I am totally unable to place the larva now described in any existing genus, and even the family remains in doubt. There is an obvious superficial resemblance to some of the Nymphalids, but it appears to be only superficial. I should rather seek to place the insect somewhere in the neighbourhood of the Arctiid-Noctuid stem, but just where I do not know. May I ask for the advice and criticism of those who have a better knowledge of lepidopterous larvæ?

LIST OF HEMIPTERA TAKEN AT COMO, QUEBEC, DURING THE SUMMER OF 1906.

BY GEO. A. MOORE, MONTREAL.

(Continued from page 163.)

HOMOPTERA.

Membracidæ.

Entilia bactriana, Germ.—July 8. Common on Thistle.
Ceresa bubalus, Fabr.—July 23. Common.
Ceresa brevicornis, Fitch.—July 27. Several.
Ceresa diceros, Say.—July 26. Common.
Thelia univittata, Harr.—July 27. One specimen.
Archasia galeata, Fab.—July 7. One specimen.
Acutalis dorsalis, Fitch.—Aug. 4. Scarce.
Cyrtolobus varius, Godg. ?—July 14. Oak, common.
Ophiderma salamandra, Fairm.—Aug. 3. One specimen.
Carynota marmorata, Say.—July 23. Several.
Enchenopa binotata, Say.—July 25. Several.
Campylenchia curvata, Fabr.—July 15.

Fulgoridæ.

Bruchomorpha oculata, Newm.—July 25. Several.
Lamenia vulgaris, Fh.—July 23. Common.
Scolops sulcipes, Say.—July 24.—Common.
Cixius stigmatus, Say.—Aug. 2. Three specimens.
Cixius pini, Fh. ?—Aug. 2. One specimen.
Otiarus 5-lineatus, Say.—July 26. One specimen.
Pissonotus marginatus, V. D.—July 8. One specimen.
Laccocera vittipennis, V. D.—July 25. One specimen.
Phyllodinus nervatus, V. D.—July 14. One specimen.
Liburnia pellucida, Fabr.—July 20. Several.
Liburnia campestris, V. D.—July 6.
Liburnia lutulenta, V. D.—July 20.
Liburnia puella, V. D.—Sept. 2.
Liburnia furcata, Prov. ?—July 20.

Cercopidæ.

Aphrophora 4-notata, Say.—July 15. Common.
Philænus spumarius ustulatus, Fall.—July 8. Common.
Philænus lineatus, Linn.—July 2. Common.
Clastoptera obtusa, Say.—July 15. Common.

Clastoptera proteus, Fh., var. flava, Ball.—July 24. Several.
Clastoptera proteus, Fh., var. vittata, Ball.—July 25. Several.
Clastoptera proteus, Fh., var. nigra, Ball.—July 25. Several.

Bythoscopidæ.

Bythoscopus variabilis, Fitch.—July 14. Several on Oak.
Bythoscopus nigrinasi, Fitch.—July 15.
Pediopsis viridis, Fitch.—July 25. Several.
Pediopsis insignis, V. D.—July 20.
Idiocerus Provancheri, V. D.—July 28. Several.
Idiocerus alternatus, Fh.—July 26.
Agallia 4-punctata, Prov.—July 15.

Tettigonidæ.

Oncometopia costalis, Fabr.—July 27. Two specimens.
Tettigonia bifida, Say.—July 25. Common.
Tettigonia gothica, Sign.—Aug. 4. Common.
Diedrocephala coccinea, Forst.—July 14. Common.
Dræculacephala novæboracensis, Fitch.—July 2. Common.
Helochara communis, Fitch.—July 14. Common.
Eucanthus acuminatus, Fabr.—July 8. Two specimens.
Gypona Quebecensis, Prov.—July 24. Common.
Xestocephalus pulicarius, V. D.—Sept. 2. One specimen.

Jassidæ.

Paramesus vitellinus, Fitch.—July 26. Several.
Platymetopius acutus, Say.—July 20 and Aug. 4.
Deltocephalus Sayi, Fitch.—July 8 and Sept. 3.
Deltocephalus Minki, Fieb.—July 20.
Deltocephalus inimicus, Say.—July 2.
Scaphoideus auronitens, Prov.—July 30. One specimen.
Scaphoideus immixtus, Say.—July 23. Common.
Athysanus plutonius, Uhler.—July 2.
Athysanus Curtisii, Fitch.—July 2. Common.
Eutettix seminuda, Say.—July 8. One specimen.
Phlepsius fulvidorsum, Fitch.—July 27.
Thamnotettix clitellaria, Say.—July 2. Several.
Chlorotettix unicolor, Fitch.—July 14. Several.
Chlorotettix lusoria, Osb. and Ball.—July 25.
Jassus olitorius, Say.—Aug. 12.
Gnathodus punctatus, Thunb.—July 25.
Gnathodus viridis, Osb.—July 2.

Typhlocybidæ.

Dicraneura communis, Gill.—July 14.
Empoasca atrolabes, Gill.—July 8.
Empoasca mali, LeB.—July 23. Several.
Empoasca unicolor, Gill.—July 8. Two specimens.
Empoasca viridescens, Walsh.—July 31.
Eupteryx flavoscuta, Gill., and var.—July 15. Several.
Typhlocyba tricincta, Fitch.—July 2.
Typhlocyba bifasciata, G. and B.—July 21.
Typhlocyba sp., near tenerrima, H. S.—Sept. 2.
Typhlocyba comes, Say.—Sept. 2. Common on wild grape.
Typhlocyba comes, Say, var. 8-notata, Walsh.—Sept. 1. Wild grape.
Typhlocyba comes, Say, var. vitifex, Fh.—July 8.
Typhlocyba comes, Say, var. vitis, Harr.—July 31.
Typhlocyba comes, Say, var. ziczac, Walsh.—July 30. Wild grape.
Typhlocyba vulnerata, Fitch.—July 31 and Sept. 1.
Typhlocyba querci, Fh.—July 2. Oak.
Typhlocyba sp., near querci, Fitch.—July 15.
Typhlocyba rosæ, Linn.—July 7.

Psyllidæ.

Psylla carpini, Fh.—Aug. 2.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 21.

The Scolytidæ or Engraver-beetles.*

BY J. W. SWAINE, ITHACA, N. Y.

Scolytidæ have been described from almost every portion of this continent from Mexico to Alaska, and will probably be found wherever their food-plants occur. Many species are described from the West Indies, and a very large number from Central and South America, and from Europe. Many are known from Japan, Australia, Ceylon, South Africa and elsewhere. A few species seem almost world-wide in distribution; others are known only from small regions. A number of injurious species, *e. g.*, Scolytus rugulosus and Xyleborus dispar, have been introduced into America from Europe. Over 1,400 species of Scolytids are already described.

The North American members of the family Scolytidæ are usually somewhat elongate and cylindrical in form, and brown or black in colour.

*Contribution from the Entomological Laboratory of the Cornell University.

They vary from one to a little over eight millimeters in length. *Crypturgus pusillus* is one of the smallest species, and *Dendroctonus valens* probably the largest. The legs are rather small and weak, as becomes their habits. The antennæ are short and geniculate, with an extremely large club, which is usually annulated. The vast majority of Scolytids cut their breeding-tunnels in the bark or wood of trees or shrubs. The chief North American exceptions are referred to below.

The burrows of the Scolytidæ are of great interest, and often of remarkable regularity and beauty. The burrows of many species are so characteristic that it is often easy to guess which species has been at work from an examination of the tunnels and galleries alone. (Figs. 10 and 11.)

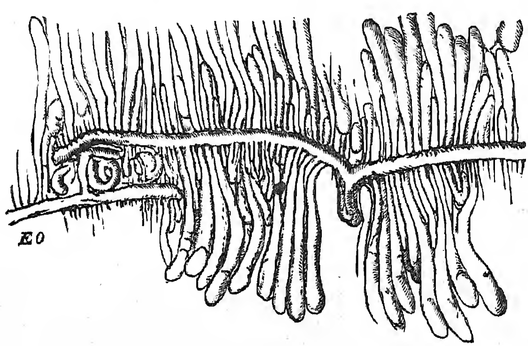


FIG. 10.—Burrows of Scolytidæ.

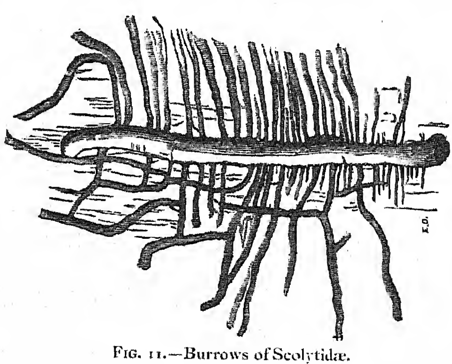


FIG. 11.—Burrows of Scolytidæ.

About one-quarter of our North American species infest coniferous trees, the Pines and Spruces being especially subject to attack. Of

deciduous trees, the Oak, Beech and Hickory suffer severely, and there is scarcely a northern tree but serves as food-plant for one or more species of this family. As a rule each species has a limited number of food-plants, but some few, like *Pterocyclon mali*, feed in many trees, both coniferous and deciduous.

According to their habits, the North American Scolytids may be separated into four fairly well-marked groups: the Bark-beetles, the Timber- or Ambrosia-beetles, the Twig-beetles, and a fourth group containing a few species of varying habit.

THE BARK-BEETLES.—The first of the above-named groups includes those forms which burrow in the bark, or between the bark and the wood. The adults enter through a hole in the bark, cut in many cases by the male, and drive a primary-tunnel, usually partly in the bark and partly in the wood, and generally either parallel with or at right angles to the wood-fibres. A few species burrow entirely in the bark, and a few species, included here in the Bark-beetles, cut their tunnels just below and parallel to the wood surface. The length of the tunnels varies in the different species from less than an inch to more than a foot. The female, at least in many species, does the greater part of the work, while the male guards the opening and removes the chips and refuse. These main-tunnels are always kept strictly clean. In sweeping the tunnels the beetles move backwards, scraping the refuse with the mandibles back to the fore legs, which pass it on to the middle, and these to the hind pair. When the opening of the tunnel is reached the tip of the abdomen is protruded and the refuse passed up to the hind pair of legs in the manner just indicated, and by the hind legs pushed away from the opening. During this operation the beetle turns in the burrow, thus distributing the refuse evenly about the opening. In cutting the tunnels also, the beetles constantly revolve, thus obtaining such perfectly cylindrical burrows.

When not at work one beetle is usually guarding the entrance. By backing into the entrance-hole the declivity of the elytra plugs the opening, and thus presents a complete protection from many enemies. The truncate character of the elytra serves well for this purpose, forming a continuation of the surface of the wood.

In niches along the sides of the primary-tunnel the whitish, almost transparent, eggs are laid, usually one, though sometimes several, in each niche. In some species, however, *e. g.*, *Dendroctonus terebrans*, they are laid in clusters along the sides of the primary-tunnel.

When egg-laying is completed the adults usually die, and their remains may frequently be found long after in the tunnel. Some species, however, cut a new tunnel and rear a second brood. With certain species, *e. g.*, *Chramesus icoriæ*, one sex, usually the male, backs into the entrance-hole, and, dying in this position, helps to guard the larvæ from such enemies as might wish to enter the burrow.

In those species which lay the eggs in masses along the sides of the primary-tunnel, the larvæ burrow in congress through the bark, forming irregular cavities extending laterally from the primary-tunnel.

When the eggs are laid in niches the larvæ burrow separately through the bark or between the bark and the wood, at right angles to the primary-tunnels; these side tunnels, larval galleries or mines thus formed increase in size as the larvæ grow, and are left completely filled with wood or bark fragments which have passed through the body of the larvæ. The latter feed entirely upon bark or wood.

If the direction first assumed by the larvæ is not parallel with the wood-fibres, the larval-mines are usually found to turn, tending to follow the direction of the fibres. The larvæ at and near the ends of the primary-tunnel swing around almost immediately, while those nearer the middle do so as rapidly as is possible without encroaching upon the mines of their neighbours. Usually the larvæ keep carefully to their own preserves, only crossing a neighbour's gallery when necessity compels them to do so. When the larval mines are entirely in the bark their direction has no definite relation to that of the wood-fibres.

After the larval development has been passed, varying in length with the species, the ends of the larval mines are enlarged and sometimes driven down into the wood to form the pupal chamber. In some species the pupal period lasts but a week or ten days, in others the winter is passed in this condition. After transformation is completed, the young adults cut their way out through the bark, forming the openings known as "shot-holes."

While the primary-tunnel and also the egg-niches are usually deeply engraved in the wood, the larval-mines are often entirely in the bark, or only cut the wood at the pupil-chambers. On Ash trunks, where the bark is thick, the larval-mines of *Hylesinus aculeatus* but slightly engrave the wood surface, while on small branches, where the bark is thin, the mines often cut the wood as deeply as they do the bark.

Frequently a number of primary-tunnels, not always cut by the same individual, radiate from a common "nuptial-chamber" situated just beneath the common entrance-hole. In such cases, at least with some species, the male cuts the entrance-hole, the nuptial-chamber and often the beginnings of three or four primary-tunnels. The male is then joined by one or more females, which finish the primary-tunnels and the egg-niches; the work of the male after the entrance of the females consists mainly in removing the chips and refuse and guarding the entrance-hole.

When the primary-tunnel is long, as is the case, *e. g.*, with several species of Tomicus, there may be one or more "ventilation holes" through the bark.

After the labours of egg-laying are over, the adults of some species of Bark-beetles cut irregular, winding "food-tunnels," deeply engraving the sap-wood. Some species hibernate in their food-tunnels, and others in short burrows apparently cut for the purpose.

A number of species hibernate as larvæ, some as pupæ, others as adults, and with some species all three stages may be found in the burrows during the winter.

The Bark-beetles include by far the largest number of our North American species.

(To be continued.)

THE AMBROSIA BEETLE (XYLEBORUS XYLOGRAPHUS, SAY), AS AN ORCHARD PEST.

BY O. E. BREMNER, SAN FRANCISCO, CALIFORNIA.

During the early spring of 1904 my attention was called to the injury being done to Peach and Prune trees in the Dry Creek Valley, Sonoma County, California, by a minute beetle which proved to be one of the Ambrosia Beetles, *Xyleborus xylographus*, Say.

The most interesting fact to me was the nature of the attack, for contrary to all former reports of the depredations of this beetle, I found it attacking perfectly healthy Peach trees, and also Prune trees in a perfectly healthy state, as well as those which seem to be suffering from an excess of moisture, heat or cold, as the case might be. In the case of the Peach trees there was a marked exudation of gum, but this did not seem to hinder the onward work of the borer, but did, however, prevent the mouth of the gallery from being kept open, which resulted in the healing

of the wound, and no damage could be seen the following year from the attack.

With the Prunes it was different; there was no gumming, and only the very small pin-hole, with its little trail of wood-dust to mark the spot where the little borer was industriously working within; but six such holes were sufficient to cause the death of the tree.

The food of these beetles is a fungus grown on the walls of the galleries and chambers made by the beetles, and develops only under certain conditions, namely, when the tree is in a diseased or dying condition, and in the case of these fruit trees this condition is brought about by the attack of the beetle itself. On each side of the hole for more than a quarter of an inch and extending up and down the body of the tree for from six inches to two feet, and continuing inward as far and as fast as the gallery progresses, the wood of the tree turns brown, and gives off an odour, exactly similar to those conditions arising from the so-called sour-sap disease, and under this condition the Ambrosia seems to develop even better than where the trees seemed to have been attacked, after having partially succumbed to some other cause.

There seems to be no special time for attack, but from early spring until late fall I found trees being attacked, and galleries containing beetles in all the stages of development. As to remedies I found all those prescribed to be of no avail. Plugging, opening the galleries to the light, external and internal applications, seemed to have no effect. The only remedy, other than that of removing the affected trees and burning, would be a heavy fumigation with hydrocyanic acid gas when the trees are dormant.

The beetles always enter the tree from the north and east sides, and rarely more than six feet from the ground. Another point of interest is: As soon as a gallery terminated in a chamber, an adult of the colony took up its station at the door of the gallery with the tip of the elytra just flush with the surface of the bark, where it suffered death rather than admit an intruder, for in every case that I inserted a wire I found that this beetle died rather than escape, which it could easily have done by running along the gallery to the chamber. This sentinel also seems to act as garbage man for the colony, removing all excess of wood-dust and excreta not needed in the propagation of the Ambrosia.

A description of this beetle can be found in Bulletin 7, New Series Division of Entomology, U. S. Department of Agriculture.

CECIDOMYIIDÆ: A STATEMENT.

BY E. P. FELT, ALBANY, N. Y.

The Gall Midges, though extremely small in size and frequently of very uniform colouring, are, nevertheless, easily referable, for the most part, to family, genera and species, by characters found on the insects themselves. Inasmuch as two and sometimes three or four different species may inhabit the same gall or very similar galls on the same plants, it must be admitted that a system dependent largely upon plant deformations is not entirely satisfactory. Moreover, a number of species, including in this category practically all the members of two important subfamilies, produce no vegetable deformations. Obviously these latter species, if identified at all, must be separated by characters presented by the insects themselves. The minute we allow this, there must be some method of distinguishing them from the host of other species with which they might be confused if taken in the field away from the galls in which many forms breed. Our correspondents may be interested to know that the preliminary descriptions issued from this office have, in every instance, been condensed from more detailed characterizations (not to mention numerous photomicrographs and other illustrations), all bearing the same number and easily associated with specimens similarly marked, consequently there can be no question later on as to the identity of the forms described. Furthermore, we are now engaged in a serious systematic and biologic study of this group, and have already well in hand a series of tables for the separation of not only subfamilies and genera, but also species, in such a manner that all may be recognized irrespective of the plant or material in which they breed. This, it seems to us, is the only logical basis for a classification, and something that is imperatively needed, particularly when it is remembered that very few of the published descriptions are sufficient for the identification of adults, unless they are taken in connection with the galls. Obviously, progress must be seriously hindered if this condition is allowed to persist, since many of the earlier described species can be identified only by securing the galls and breeding the insects therefrom. We would not imply by the above that the biological study of this group should be neglected, far from it; this phase should be pushed with all possible vigour. We do urge the necessity of a thorough study of the adults and the replacing of the present more or less insufficient descriptions by characterizations that will bring out the specific differences most clearly.

The above statements are made at this time owing to the fact that

certain strictures* on our recent work have appeared. The critic seems to have overlooked the fact that the descriptions referred to in particular are simply preliminary; he was presumably unaware that they are based upon detailed descriptions, and appears to have ignored the fact that most species bear excellent generic and specific characters, and that a number, at least, can under no circumstances be associated with any vegetable deformation. There is no reason why adults of this group should not be studied independently of the earlier stages any more than in the Hymenoptera, Lepidoptera and other orders. It is regrettable that there must inevitably be some confusion between a system which, sooner or later, will break down on account of its own limitations, and the introduction of one based upon well-accepted systematic principles. The earlier the change is made, the better for this branch of entomology, and we hope shortly to have the pleasure of demonstrating the wisdom of this course.

THE CLASSIFICATION OF THE CULICIDÆ.

BY EVELYN GROESBEECK MITCHELL, WASHINGTON, D. C.

In Dr. Williston's article under the above head (CAN. ENT., Dec., 1906), he advocates uniting the Corethridæ and Dixidæ with the Culicidæ. Yet Schiner, praised by Dr. Williston as a model systematist, erected the family Dixidæ, while Brauer, whom Williston condemns, was in favour of its union with the Culicidæ.

Why should the Corethridæ, whose larvæ and pupæ differ greatly in structure and habits from those of the Culicidæ, be placed in the latter family? Not only do the early stages differ, but the mouth-parts of the adults, admittedly of importance in the classification of the Diptera, are not fitted for biting, and are comparatively short, in contradistinction to the long Culicid proboscis, which is so constructed as to enable not only the females but also males of certain genera to obtain blood. The palpi of Corethridæ are slender, very flexible and strongly recurved, whereas in the Culicidæ the palpi are robust, almost straight, rigid and directed forward. Corethridæ are said to deposit their eggs in a mass of gelatin, a method of oviposition unknown among the Culicidæ, and their pupæ float submerged or, in the case of Corethrella, on the surface, not being active like those of Culicids.

Mr. M. T. Thompson, of Clark University, who has been making special comparative studies of the internal anatomy of the adults and larvæ of many of the Diptera, the results of which he intends later to publish, has very kindly informed me of some of these results, giving permission to

*1907.—Beutenmueller, Wm., new species of Gall-producing Cecidomyiidæ. Amer. Mus. of Nat. Hist. Bull., Vol. 23, Art. 18, p. 385-400.

quote them in this paper. The Diptera he has studied seem to fall into two groups, those where the antlia or pumping stomach is simple, and those in which it is divided by a semisphincter muscle into two parts, the latter being the case with the more primitive forms, while among the higher forms (Dolichopodidæ, Muscoidea, etc.), the posterior division is wanting. In Corethra, Simulium, the Tabanidæ, Bombylidæ, Therevidæ, Asilidæ, etc., the preneural and the postneural parts of the antlia are thus divided, no trace of the separating semisphincter muscle being found in Culex or Anopheles. There are in Corethra four anterodorsal dilator muscles instead of two as in Culex and Anopheles. It has, like these, three œsophageal diverticulæ, but only four rectal papillæ, where these possess five. Furthermore, Mr. Thompson finds that Corethra differs from Culex and Anopheles in having the hypopharynx connate with the labium in both sexes; possessing four instead of five malpighian tubules; simple instead of tripartite salivary glands; no clypeus, this being replaced by an oval sclerite; and no "proboscis canal." He remarks that the internal characters would seem to indicate that Corethra is neither a Culicid nor a Simuliid, but a lateral branch low down on the Culicid stem; the larvæ, which lack flabellæ and differ in rostrum, place of attachment of antennæ, presence of air floats, form of body, division of foregut, etc., tend to confirm this. He at present regards the evidence, while pointing to a close relationship of Corethra to Anopheles and Culex, and showing notable relationship between Corethra and Simulium, as indicating that Corethra and Anopheles have the same common ancestor, the former and more primitive branching off at a lower point on the ascending scale, while Culex may be derived from Anopheles. Would there be any gain by merging such heterogeneous elements as Culex and Corethra in the same family?

Likewise, why should the Dixidæ, whose wing-veins are bare of scales, and whose larvæ and pupæ differ so from those of the Culicidæ, be included with the latter? Among the Dixidæ the antennæ of the adults are almost bare, and are quite similar in the two sexes, whereas in the Corethridæ, and with but one known exception in the Culicidæ, they bear long hairs, which, except in a few Culicid cases, are longer and much more numerous in the antennæ of the males than in those of the females. The subcosta of the Dixidæ is short, reaching only to a point opposite the first branching of the radius; in the other two families it is prolonged nearly half its length beyond the first branching of the radius. Moreover, the larvæ of the Dixidæ are distinguished by having the three thoracic segments always distinct and by two pairs of fleshy appendages, resembling prolegs, on the first and second abdominal segments, no trace of anything like prolegs being found in either of the other two families. The pupæ are inactive, floating quietly on the surface.

Had Dr. Williston personally investigated the early stages of these insects before writing his criticism, I feel certain that his view would differ widely from that which he now holds.

Admittedly, more than in any other order of insects, the early stages in the Diptera assume unusual importance in separating the order into the higher groups. Thus the primary divisions, Orthorhapha and Cyclorhapha, are founded entirely on larval characters and manner of pupation. The adults possess not one character whereby they may be separated from those of the opposite group, yet no one doubts the validity of the two divisions. In judging, therefore, of the value of groups in this order, it should be borne in mind that although the adult characters may sometimes appear but slight, still the group may be strongly marked as such by characters of the early stages.

This important fact Dr. Williston ignores, and overlooks also the serious disadvantages under which Mr. Theobald was working, in being obliged to deal almost entirely with the adult forms, and in not being a trained dipterologist. Under these circumstances it must be admitted that Mr. Theobald acquitted himself very creditably.

In criticising Mr. Coquillett's classification, especially that portion of it dealing with the subfamilies Psorophorinæ and Culicinæ, Dr. Williston may be pardoned for not being aware of the fact that these two subfamilies were separated chiefly by characters of the early stages. These, or any other characters of early stages of Culicidæ, however, Mr. Coquillett is forbidden to refer to or even to study further, in order that the field may be left clear for the nondipterologist, who claims it as "pre-eminently his own," and insists on its being reserved as such. Thus it happened that in Mr. Coquillett's classification only the weakest characters, those derived from the adults, were given. In passing be it noted that it is the outstanding scales *plus* the narrow wing scales which form the distinctive character of the adult of the Psorophorinæ, as well as the arrangement of the outstanding scales, not the narrow scaling *alone*, as Dr. Williston seems to think was intended. Narrow or broad wing-scales alone would certainly not distinguish a subfamily. Also, I agree with Dr. Williston that natural genetic characters, such as palpal ones, should be used when present. But if they are difficult of detection, and their finding involves the possible destruction of the specimen, it seems as if some other more prominent, even though artificial, character should be found if possible, to be used as an accessory character for easy identification.

In order that the standing of the two subfamilies, Psorophorinæ and Culicinæ, may be more clearly understood, their chief characters are here appended :

CULICINÆ.	PSOROPHORINÆ.
LARVÆ never insectivorous, their mouth-parts fitted for directing current of water into mouth, for sifting and brushing.	LARVÆ insectivorous, their mouth-parts fitted for seizing and tearing.
MOUTH-BRUSHES of many spreading, slender hairs, some of which are, in some cases, lightly pectinate on about the distal sixth; the hairs project forward.	MOUTH-BRUSHES a few appressed plates, heavily pectinate along the entire inner margin, and directed obliquely backward beneath head or held out at right angles to it.
MAXILLÆ conical, no hooked spines, but many long, movable hairs and short hairs.	MAXILLÆ trapezoidal, with many curved spines, a few short hairs.
LATERAL COMB of mandible of many movable, long, triangular plates, their base at an acute angle with top of mandible.	LATERAL COMB of mandible a few heavy, immovable spines, their base almost at right angles with top of mandible.
MARGINAL COMB of mandible 15–20 immovable spines.	MARGINAL COMB of mandible absent.
BITING part small.	BITING part very large.
ANTENNÆ near anterior margin of head, eyes near middle of sides of head.	ANTENNÆ near middle of sides of head, eyes near posterior margin.
PUPÆ with anal flaps longer than broad.	PUPÆ with anal flaps as broad as long.
ADULTS with femora devoid of outstanding scales except in the genus Ædeomyia, where they form a fringe along the upper and the lower side of the apices of the femora and the bases of the tibiæ. The wing-scales of this genus are broad, and its larval and pupal characters typically Culicid.	ADULTS with femora and tibiæ bearing many outstanding scales irregularly and thickly arranged around them, never a fringe. Wing-scales narrow.

The eggs of Psorophora are distinctive, being symmetrically ovate and distinctly differing from the thirty-odd of the Culicid eggs which I have seen, but the difference is easier to see and illustrate than to describe. The others are not nearly so ovate, generally unsymmetrical, and their small diameters proportionately less as compared with the long diameter than in the Psorophora eggs.

A NEW BUTTERFLY OF THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y., AND FRANK E. WATSON, NEW YORK CITY.

INCISALIA POLIOS* (new species).

Type ♂: Abdomen and thorax brown above, the former ashen beneath; antennæ dark brown, ringed with white, the club tipped with rufous, the basal third white beneath; eyes narrowly edged with white. Upper surface of wings dark brown (as in the congeneric species), with a little red-brown near the anal angle; fringes white, the long scales tipped with brown, interrupted with brown at the end of each nervule; next to the fringe two fine, parallel brown lines, between which is a lighter line interrupted by the nervules, and within which is *a continuous, distinct white line.* Secondaries somewhat produced at tips of nervules, but *not tailed.* Stigma present. Under surface of primaries warmer brown, with an irregular extramesial white stripe from the costa to the first median nervule, edged inwardly with dark brown; about midway between this and the outer margin a series of five small, distinct, dark brown, nearly circular spots, not more than one in any interspace; *outer half of area between these spots and the margin, hoary.* Two obscure dark lines crossing the cell. Under surface of secondaries: Basal half nearly uniform pitch brown, limited exteriorly by a fine broken white line (next to and within which the colour is deepest), obscurely variegated with lighter shades; outer half of wing with an arcuate series of eight rich chestnut-brown dots paralleling the outer margin, one to each interspace, except between the first and second median nervules, where there are two, the outer roughly crescentic, with tips toward the inner, which is smaller and round, the space between them lighter brown. Basal area with greatest projection between the second and third median nervules. Beyond the spots the wing is ashen-gray as far as the inner of the two fine marginal lines, which are much as on the upper surface, except that near the outer angle the gray is present only near the margin. The same ashen colour fills the space between the dark basal area and the series of spots, from the third median nervule to the inner margin. At the end of each nervule this hoary border is indented by a small black triangle. Expanse, 29 mm.

Type ♀: Outer margins of all wings more strongly rounded than in ♂; white parts of margin and fringe above less distinct, especially on

*πολιός = hoary.

primaries. Beneath: Basal two-thirds of primaries darker than outer third, black lines in cell very faint; inner edge of hoary margin cleaner and in sharper contrast with the brown. Secondaries very much as in type ♂; white margin of basal area wanting, except for a dash near the costa; hoariness between arcuate series of spots and basal area extending from inner margin to the free nervule; basal area somewhat lighter near costa, and with a vague sprinkling of whitish scales. The browns of both wings brighter than in ♂. Expanse, 31 mm.

Type ♂ taken at Lakewood, N. J., on April 27, 1906; type ♀ taken at Lakewood, N. J., April 21, 1907.

These types were selected from a series of 84 (all from the same locality) with a view to avoiding extremes of coloration. Of the lot, 45 have been selected as paratypes, 32 males and 13 females. The following variations are found among them: The two fine, brown marginal lines are (rarely) merged into a single broad one (both sexes); the white line within these is (frequently) reduced, though never wholly absent; some specimens have a bronze or olivaceous reflection in certain lights; the rufous suffusion is often quite absent, and, on the other hand, is sometimes conspicuous, in one exceptionally brilliant ♀ (paratype No. 25) it extends to the primaries; basal area of secondaries sprinkled with yellow scales (paratype No. 15); variegation of this area (always slight) sometimes a little less, sometimes a little more, obscure than in types; extramesial stripe of primaries beneath variable in intensity, and in extension from costa (in paratype No. 25 it extends to the submedian vein); relative values of the browns beneath somewhat variable; submarginal spots on primaries occasionally rather faint, especially among the males, but always present; spots of the arcuate series on secondaries sometimes obscured or absent between the subcostal nervules.

During the winter of 1904-5 Mr. Wm. T. Davis presented the junior author with two males (April 30) and one female (April 26) of this species, taken at Lakehurst, N. J. The value of the form was not recognized by us until after two seasons of collecting, the constancy of the characteristic markings, coupled with the fact that *each year these butterflies appeared with augustus, and from a week to ten days earlier than either irus or Henrici* (both of which are found, though not commonly, at Lakewood), convinced us that it was entitled to specific distinction.

It is easily separated from *Henrici* by the presence of the discal stigma in the male, the absence of "tails" on the secondaries, the hoary margin and the prominence of the submarginal dots on the primaries beneath. The latter are in *Henrici* missing (usual) or at most represented by blurred clouds slightly darker than the yellow-brown ground.

From *irus* it may be distinguished by the relatively uniform colour of the basal area of the secondaries beneath (in *irus* this is strikingly variegated), the absence of tails, the hoary margin of the primaries, and by the almost total obliteration of the black-pupiled eye-spot, which in *irus* is a salient feature of the wing ornamentation, occupying the interspace between the first and second median nervules of the secondaries beneath.

Polios most nearly resembles *Mossi* (Hy. Edwards), from which it differs in the presence of the hoary margin of the primaries, the broad hoary area of the secondaries (in the type *Mossi* these whitish scales are confined to a small space along the inner margin, and elsewhere replaced by large chestnut-brown spots, surmounted by black crescents), and in the colour of the fringe.

Five specimens from other localities in the collection of the junior author are confidently referred to this species; they bear the following labels: ♂ and ♀, Calgary, Alberta (no date); ♀ ♀ ♀, Graham's Park, on Rio de los Pinos, Cal., May 11th and 12th, 1899. There are also specimens in the Museum of Natural History, New York City, and in the National Museum at Washington, labelled Colorado, which agree very closely with our specimens.

Undoubtedly *polios* has been confused by collectors with *irus*, *Henrici* or *Mossi*, and it is quite possible that the specimens mentioned by Scudder* as varietal forms of *irus*, having "the outer margin of the primaries. . . . narrowly hoary," should be referred to this species.

The types have been deposited in the U. S. National Museum; paratypes Nos. 1 and 2 have been sent to the Museum of the Entomological Society of Ontario; paratypes Nos. 3 and 4 were presented to Dr. Henry Skinner, of Philadelphia; paratypes 5 and 6 are now in the New York State Museum at Albany, and the other paratypes remain for the present in the collections of the authors.

*Butterflies of the Eastern U. S. and Canada, p. 837.

THE LIFE-HISTORY OF APANTELES GLOMERATUS, L.*

BY ROBERT MATHESON, CORNELL UNIVERSITY, ITHACA, N. Y.

During the past summer, while doing some work on the larva of the cabbage butterfly (Pieris rapæ), I was struck by the lack of information regarding the life-history of one of its most important parasites, *Apanteles glomeratus*, L. In none of the publications on Economic Entomology could I find any definite information, and the text-books were equally as unsatisfactory.

Reaumur, in his Memoirs, Vol. 2, pp. 417–, states that the females of this parasite deposit their eggs, one at a time, laying in all about thirty eggs in each larva. He further adds that they select the intersegmental areas as the place of oviposition, particularly between the eighth and ninth and ninth and tenth segments. W. T. Bree, in the Mag. of Nat. Hist. for 1832, pp. 105–109, states that he observed several females in the act of oviposition, and his description corresponds closely with that given by Reaumur. Both writers emphasize the fact of the fearlessness of the parasite during oviposition, and that only one egg is deposited each time. Evidently what Reaumur and Bree observed was the oviposition not of the true *Apanteles glomeratus*, L., but of *Pteromalus puparum*, L.†

Seurat, '99, in his "Contributions a l'étude des Hyménoptères Entomophages," states that the females of *Apanteles glomeratus* oviposit in the young larvæ, depositing a large number of eggs in each.

In rearing a large number of these parasites I was able to observe the act of oviposition as well as to trace their life-history. The adults, on emerging, do not immediately fly away, but remain walking back and

*Contribution from the Entomological Laboratory of Cornell University.

†(I had an excellent opportunity for observing the manner of oviposition of this latter parasite, and it corresponds exactly with that given by Reaumur and Bree for *Apanteles glomeratus*. I found *Pteromalus puparum* at work late one afternoon. It was not at all disturbed by my removing the larva to a small box. Taking them to the laboratory, I was able to observe the act of oviposition under the microscope, without in the least disturbing the insect. I watched it oviposit at intervals of about twenty minutes till nearly 11 p.m., and next morning I found it still ovipositing. It ceased early in the forenoon, so that in all probability it had laid over thirty eggs in the one larva. The conclusion, that both Reaumur and Bree had observed the oviposition of this species rather than of *Apanteles glomeratus*, is strengthened by the fact that Reaumur states that the larvæ of these parasites are sometimes found in the chrysalids of Pieris rapæ, but after the fourth day exhaust the food supply, and do not transform. This is the condition we would expect to find in the case of *Pteromalus puparum* during the latter part of August and the first of September, as it passes the winter in the larval state, and does not spin its cocoon till the following spring.)

forth over the cluster of cocoons, the males evidently waiting for the females and the females waiting to be fertilized. Mating takes place a short time after emergence, within 12–24 hours.

Immediately after fertilization the females go in search of their host larvæ. Any cabbage leaves placed in the breeding cages soon attracted their attention, and, if any unfortunate larvæ were present, they soon fell victims to these parasites. Walking back and forth over the cabbage leaves, the females kept their antennæ in constant motion. As soon as one found a larva, not too large, preferably in the first, second or third stages, she prepared to oviposit. Bending her abdomen almost at right angles to her body, the parasite rushed upon the *Pieris* larva and drove her ovipositor through the skin, while her wings, in nearly all cases, were extended dorsally, closed above the thorax. I never observed them oviposit on the dorsum, always on the latero-ventral region, and it was not infrequent to observe two or three ovipositing in a single larva at the same time. The host usually objected most vigourously to such treatment, but the parasites remained unmoved, stroking the larva with their antennæ or remaining motionless. Sometimes they endeavoured to oviposit in an older larva, but it succeeded in knocking them off, though undoubtedly some eggs were deposited. The time of oviposition varied from fifteen to twenty seconds. At each act of oviposition from fifteen to thirty-five eggs are deposited just beneath the epidermis, so that with the moulting of the host the eggs are not shed also. In one larva oviposited in three times I counted, when dissected, sixty-five eggs, and undoubtedly there were a few more which I did not succeed in finding. These eggs were found floating freely in the body cavity, and were not inclosed in packets. These facts stand in striking contrast with Reaumur's and Bree's observations.

These eggs hatch in from three to four days. The larvæ feed upon the lymph and fatty tissue of their host, carefully avoiding the vital parts. They become mature during the latter part of the larval life of their host—that is, in about eight to twelve days—and emerge by cutting their way through the skin. The spinning of their cocoons occupies scarcely over three-quarters of an hour, often less. Reaumur, Vol. 2, p. 422, gives an excellent description of the manner of spinning the cocoons.

The number of parasites reared from a single caterpillar varies greatly. The smallest number that I have reared was sixteen, and the largest was fifty-two. Bignell reports having reared one hundred and forty-two from

a single larva. In view of the recent work on polyembryony in several Hymenopterous parasites, it is interesting to note that this does not occur in the development of *Apanteles glomeratus*.

Seurat observed what he considered the moulting of these larvæ while still within their host, but Kulagin, '92 (Zoologischer Anzeiger, Vol. XV, pp. 85–87), who studied their embryological development, states that they do not moult till they emerge from their host. In none of the sections which I examined, did I find any indications which would go to show that they moulted while within the host.

At time of emergence from the host the stigmatic trunks, with the exception of the second pair, open to the exterior. About two days later they moult inside the cocoons, changing to the pupal state. The pupal period lasts from five to ten days, varying in length according to weather conditions, being longer when the temperature is low. The adults emerge by cutting a circular lid at one end of the cocoon and pushing it off. They live, in all probability, only a short time. Those reared in confinement lived only a few days, in most cases all would be dead on the sixth day after emergence.

This parasite is, undoubtedly, of great economic importance in destroying large numbers of the larvæ of the cabbage butterfly. Chittenden records in Bull. 54 of the U. S. Dept. of Agriculture a case of complete parasitization in a large number of *Pieris* larvæ examined. During the summer of 1906 I visited several small cabbage fields at various intervals from June till the last of October. During the early part of the season the number of caterpillars parasitized was very small, but later, in July and August, sometimes nearly 50 per cent. of those brought in would be parasitized. In September and October the majority of the larvæ examined were parasitized, probably on the average between 60 and 75 per cent. at that season of the year.

A NEW PHORID GENUS WITH HORNY OVIPOSITOR.

BY D. W. COQUILLETT, WASHINGTON, D. C.

Among the Dipterous family Phoridæ is a small group, characterized by the females having a large, exserted, horny ovipositor. This group is represented on this continent by two described genera, *Apocephalus* from North America, and *Melaloncha* from South America. To these is now

added a third genus, differing from the first by the simple third vein, from the second by the absence of the fringe of bristles along the outer side of the hind tibiæ, and from both by the greater number of frontal bristles, also in that the median pair in the lowest row is proclinate instead of reclinate. Some idea of the appearance and structure of this interesting form may be gleaned from the accompanying description and figures.

PSEUDACTEON, new genus.

Front slightly broader than long, bearing four transverse rows of four setæ each, the latter reclinate except the median pair in the lowest row, which are proclinate (fig. 12). Third antennal joint oval, about one-third longer than broad, the arista apical. Palpi well developed, clavate, bearing about four bristles at the apex, proboscis robust. Female with a horny ovipositor about half as long as the abdomen. Legs devoid of bristles except at the tips of the hind and middle tibiæ. Venation normal, the third vein simple. Type, the following species:

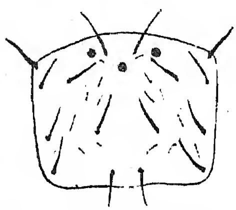


FIG. 12.—Front of Pseudacteon.

Pseudacteon Crawfordii, new species.—(Fig. 13.) Black, the pleura dark brown, the mouth-parts, legs and halteres light yellow. Wings hyaline, veins brown, the four light ones noticeably paler toward their bases. Length about 1 mm.

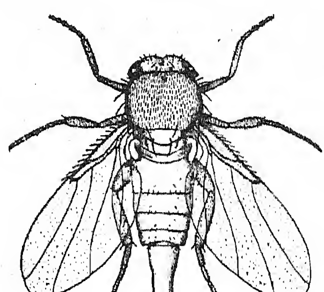


FIG. 13.—Pseudacteon Crawfordii.

Dallas, Texas. Three males and seven females collected, June 17, July 19 and October 22, 1906, by Messrs. J. C. Crawford and W. D. Pierce. One of the females was observed to apparently deposit an egg in the head of an ant, *Solenopsis geminata*, and as the Phorids were found only in the company of ants of this species, it is altogether probable that they infest the heads of the latter after the manner of *Apocephalus Pergandei*, which is known to live within the heads of another kind of ant.

Type No. 10294, U. S. National Museum.

GEOMETRID NOTES.

BY HARRISON G. DYAR, WASHINGTON, D. C.

In CAN. ENT. for April, 1907, Mr. Taylor has a note on *Euchœca perlineata*, Pack. It appears to me that he is clearly in the right in his conclusions, for in any case where published descriptions and figures contradict an alleged type, it is the evidence from the publication that must prevail. Types, even when labelled by the author himself, cannot take precedence over a published description, except in cases where an error of observation can be demonstrated.

I think it has not been put on record that *Cosymbia albocostaliata*, Pack., is a Noctuid. It will be probably best placed in *Pleonectyptera*, Grote, and, to follow Professor Cockerell's recommendation (CAN. ENT., XXXIX, 136, 1907), I hereby provisionally nominate it *Pleonectyptera albocostaliata*. There is a specimen in the Neumœgen collection in the Museum of the Brooklyn Institute, and two in the U. S. National Museum, the latter collected by Mr. W. F. Fiske at Tryon, North Carolina. I have not seen the type, but the specimens agree perfectly with Packard's figure.

LAERTIAS (PAPILIO) PHILENOR (LINNÆUS).

BY A. A. GIRAULT, BLACKSBURG, VA.

On June 20th, 1903, at Blacksburg, Virginia, a colony of the larvæ of this species was obtained from vines of the Dutchman's Pipe *(Aristolochia)* growing over the ruins of an old stone building. The majority of them were nearly full-grown, and the whole colony was placed in a breeding cage and supplied with food. I offer the following notes at the risk of repeating:

The Larva.—Nothing especially important was noted concerning the caterpillar, excepting a variation in the number of spots in the dorsolateral line. This line of orange spots or tubercle areas consists usually of a tubercle on the first abdominal segment just above the spiracle, and four tubercle areas, one on the 4th, 5th, 6th and 7th abdominal segments respectively, and all about the same size, but varying somewhat in colour. In the case of one larva, an additional area was present on the 8th abdominal segment, but was faint; in another larva, after the first segment, the areas began on segment 3 instead of the 4th, continuing to the 7th (inclusive). Two larvæ were found with the spots running from the 3rd to the 8th abdominal segments, but those on the 3rd and 8th segments were faint. Apparently, when there are more than the usual number present the additional ones are faint. All of the larvæ were in the last

instar. The line of areas in the dorsal region may be unsymmetrical, which is often the case in lepidopterous larvæ. The osmateria secrete a bright yellow liquid of a sweetish, disagreeable odour, which is non-irritating to the hands.

In this larva the antennæ are very short as usual, but the long fleshy processes on the prothorax seem to function in their stead. When in locomotion they are held before the head, waving up and down, and the larva is guided by them. The caterpillars occasionally leave a silken trail behind them.

The larvæ may become carnivorous when hungry. Some young larvæ, more than half-grown, were placed in a breeding cage with chrysalids, and kept well supplied with food for several days until it gave out. After the growing larvæ had been without food for about 24 hours, they began to attack the chrysalids, generally eating away the entire upper half. In one case one whole side of the pupa from prothorax to abdomen was eaten, including most of the viscera, and two of the caterpillars, evidently concerned in this, were resting quietly beside the remains, plump as if surfeited. The chrysalids were eaten with apparent relish. This habit can hardly be termed cannibalism, as it was appeasance of abnormal hunger, and the larvæ did not attack the chrysalids in the presence of an abundance of their natural food.

Method of Girdling.—The larvæ began to prepare for pupation on June 23rd, along the wire gauze sides of the breeding cage. In preparing the girdle with which the pupa is suspended, the caterpillar first spins a loose web or mat of silk under its body. The girdle is then commenced by fastening a thread to this mat well under the side of the body, and then bringing it over across the venter of the thorax, inclosing the legs (the venter of thorax being arched), by bending the head backward, and then attaching the other end of the thread on the other side of the body about the same distance back and under, or just opposite the first attachment. This forms a loop of silk over an arch or curve of one side of the body. These movements are repeated five or six times, a single thread being added each time to the girdle, and the larva in fastening them from side to side has to be very careful and agile in movement. The head is thrown back, the thoracic venter arched, while the rest of the body is straight and flat against the support; therefore, the movements are nearly all cephalic and thoracic. When the girdle is finished, consisting of five or six threads of closely-applied strands of silk, the larvæ pushes or works its head under it, and by a forward and then a backward movement of its body, incloses the latter also within the loop or girdle. It is then gradually worked back to its usual position, passing

around the body in the incision between the second and third abdominal segments. After the girdle is in place, the caterpillar settles into a somewhat crouched position, and then finally arches its body as it awaits the time of ecdysis, several days afterwards. The placing of the girdle occupies about two minutes; if placed too far caudad it is liable to interfere seriously with ecdysis. Unfortunately, no observations were made during pupation, so that the method of placing the girdle by the chrysalis was not seen. Described from 13 specimens.

Duration of Pupal Instars.—The duration of pupal life for fifteen individuals reared averaged 16 days, from June 28th to July 14th, and ranged from 14 to 21 days. The males issued before the females.

NEW MICRO-LEPIDOPTERA.

BY W. D. KEARFOTT, MONTCLAIR, N. J.

(Continued from page 160.)

Cerostoma dorsimaculella, sp. nov.—Expanse, 18.5 to 19.5 mm.

Head whitish-gray, in which are mixed a few dark gray scales; palpi whitish-gray, tuft of second joint clouded with brownish-gray at the outside and at the ends, apical joint dark brown beneath and less so on the sides, whitish-gray above; antenna white, annulated with brownish-gray; thorax cinereous-gray, posterior tip whitish, inner edge and base of patagia dark brown; abdomen whitish-gray, anal tuft with a cinereous tinge; legs cream-white, heavily dusted with brownish-black in front.

Fore wing very light gray, with a slight yellowish tinge, strigulated and marked with bronzy-black. The most conspicuous marks are on the dorsal margin, below the fold; the inner is a narrow triangle, with base on dorsum at inner fourth, and apex touching fold at inner third; the outer spot rests on dorsal margin between middle and outer fourth, its upper edge is slightly concave, causing an enlargement at the inner end and a linear extension at the outer end that rises, obliquely outward, above the fold. There are two curved transverse lines from costa, before middle of wing, not reaching fold, beyond them are five shorter costal streaks, before the outer fourth. Below these latter, at the end of cell, is an angulated line, with a few blackish scales above and below it. There are a few dark dots in the line of the middle of the wing, one at base, one a little beyond base, and two near middle of cell. There is a large dark dash in apex, which extends into cilia, becoming paler at the tip. A few dark scales at end of cell, and another small cluster above tornus. Cilia concolorous.

Hind wing paler gray than fore wing, slightly darker around termen, cilia paler, with a faintly darker basal line. Under side the same, a black dot on costa before apex. Under side fore wing darker gray, with a few black dots on costa before apex.

Four specimens, Rounthwaite, Man., July 11 and 12, L. E. Marmont.

Co-type in U. S. Nat. Mus., Cat. No. 9870. I am indebted to Mr. Busck for correcting my generic determination of this species.

Mompha Claudiella, sp. nov.—Expanse, 20 mm.

Head and patagia white, with a faint rosy tinge; palpi white, with a few dark scales on outside of tuft of second joint; antenna fuscous, with a whitish bloom; thorax leaden-black in centre, narrowly edged in front with rosy-white; on posterior half there is a patch of deep rosy-white, and the middle scales at their posterior end are of the same colour; abdomen gray, anal tuft with an ochreous tinge; legs cream-white, heavily shaded with black in front.

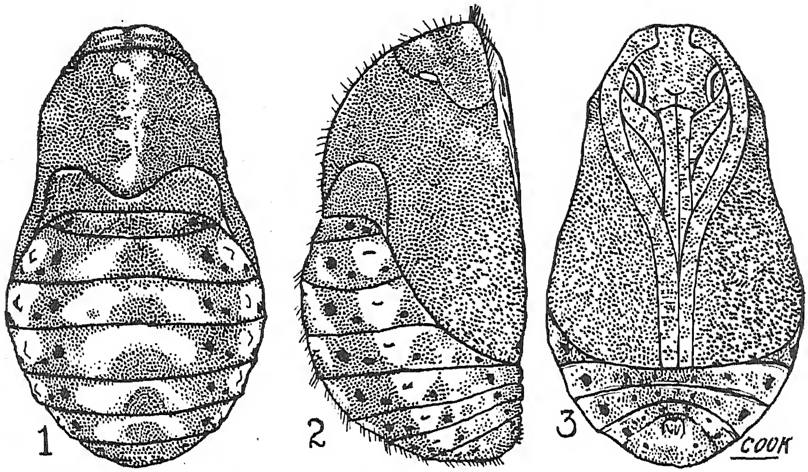
Fore wing white, with a faint rosy tinge, shaded with bluish-gray on inner fifth of costa, and a shade of the same colour through middle of wing from inner tuft to end of cell. A small shade of this colour on outer third of costa, and a similar one below it on dorsal margin. The upper half of termen and apex are shaded with gray, in which are sprinkled whitish, black and brown scales; there is a dark brown dot in cilia at apex, and two before apex in costal cilia, and one below apex in the long cilia; the outer ends of the apical cilia are gray, otherwise the cilia is ochreous. The tufts are very large and high; the three most prominent ones are white towards base and ferruginous at their outer ends. There are two close to base of wing, one in middle of wing, and one below it and obliquely outward from it close to dorsal margin.; before the latter, and in a streak following the former, are broad black scales; the third is between fold and dorsal margin in middle of wing; it is also followed by a patch of broad black scales from its upper end. There is a smaller but similar tuft at outer fourth of wing, on lower margin, and a small tuft above the third large one on upper half of middle of wing. Below costa, at inner third, is a small tuft of black scales.

Hind wing dark gray, cilia ochreous, the same shade as cilia of fore wing. Under side both wings smoky black, with a whitish streak through middle of hind wing, and the apex of both wings whitish.

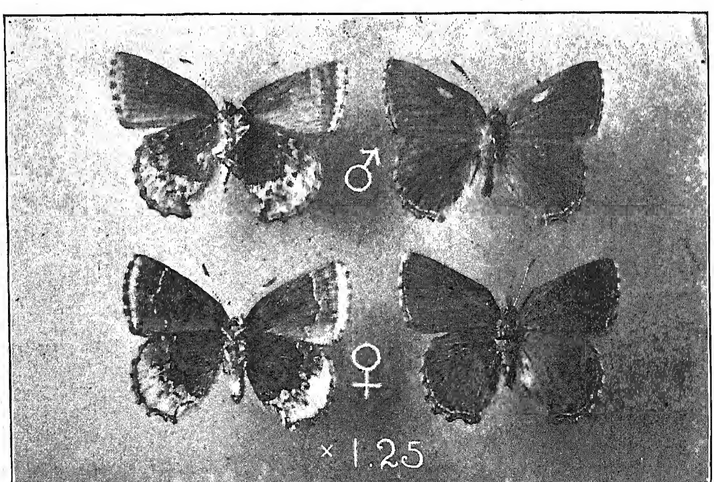
Three specimens, Rounthwaite, Manitoba, July 11 and 12, collected by Claud Marmont, whose name I am glad to give to this very beautiful species.

Co-type in U. S. Nat. Mus., Cat. No. 9871.

Mailed June 4th, 1907.



INCISALIA HENRICI—CHRYSALIS.
(Dorsal, lateral and ventral aspects.)



INCISALIA POLIOS, COOK AND WATSON.

The Canadian Entomologist.

Vol. XXXIX. LONDON, JULY, 1907. No. 7.

THE STRIDULATION OF THE SNOWY TREE-CRICKET (*ŒCANTHUS NIVEUS*).

BY A. FRANKLIN SHULL, ANN ARBOR, MICH.

I.—Introduction.*

Dolbear (1897), in writing of the chirping of a common cricket, which was probably the Snowy Tree-cricket (*Œcanthus niveus*), described the regularity of rate as "astonishing, for one may hear all the crickets in a field chirping synchronously, keeping time as if led by the wand of a conductor." In an adjoining field, he said, the rate was the same, but the beat was different; that is, the notes did not occur at the same instant. He expressed the relation of the rate to the temperature by the formula $T = 50 + \frac{N-40}{4}$, where T is the temperature Fahrenheit, and N is the number of chirps per minute. For convenience, the formula may be reduced to $T = 40 + \frac{N}{4}$. Dolbear does not say that the cricket referred to is *Œcanthus niveus*, though he has generally been so interpreted. Folsom (1906) conjectures that he refers to a species of *Gryllus*, but I see no reason for this assumption, except Dolbear's mention of daytime chirps, which are comparatively rare with *Œcanthus niveus*. It seems more probable, as Edes (1899) suggests, that the cricket found chirping in the daytime was another species which Dolbear confused with *Œcanthus*. Certainly his formula and statements agree more closely with *Œcanthus niveus* than with any species of *Gryllus*.

Carl A. and Edward A. Bessey (1898) derived from observations made on *Œcanthus niveus* previous to the publication of Dolbear's paper the formula $T = 60 + \frac{N-92}{4.7}$, which differs notably from Dolbear's in making the increase of rate 4.7 instead of 4 per degree rise in temperature. They stated, moreover, that below 60° the rate was higher than would be expected from the formula, thus making it evident that the curve of temperature could not be represented by a linear equation.

Edes (1899) found that while all the individuals of *Œcanthus niveus* performed in the same tempo, yet the chirps did not occur at the same instant. Using some observations of his own and those of Walter Faxon, he tested Dolbear's formula, and found that the increase of 4 per degree in the rate was nearly correct, but the different sets of data disagreed in

*Contribution from the Zoological Laboratory of the University of Michigan.

the constant term, one making the temperature two or three degrees lower than the other. Edes does not say that the temperatures were read from a standard tested thermometer, and the discrepancy noted was just such as might be expected from the use of incorrect thermometers.

II.—Statement of Problem and Method.

To test the formulas of Dolbear and Bessey, I counted the chirps of several crickets, and from them computed the temperatures. Finding that the computed temperatures were sometimes considerably in error, I undertook a series of observations to determine (1) whether the discrepancy was to be found in any very large proportion of the crickets, and if so, (2) to discover, if possible, the cause of the discrepancy.

These observations were made on *Œcanthus niveus* in Ann Arbor, Mich., in the level country near New Carlisle, Ohio, and on the hillsides of Ithaca, N. Y., in the summers of 1905 and 1906. At first all observations were made with the insect in view. Lantern in hand, I cautiously approached the point in the bushes from which the sound issued until the chirping insect was discovered and the chirps found to coincide with the motion of the wings. The crickets were not at all disconcerted by this procedure, and often permitted me to approach within two feet.

After having observed some 75 specimens by means of a lantern, I found that chirping crickets were rarely closer together than three or four feet, and hence that an individual could easily be picked out by sound. Thereafter I relied upon sound alone for the determination of rates. Of the observations made with a lantern, the only one recorded in the following pages is the one mentioned in the discussion as having chirped 2,228 times in succession. An ordinary watch was used in timing, and to minimize the error, each count was continued through several minutes. Temperature readings were taken within a few minutes of making the count, and all readings were made from the same thermometer. This thermometer was afterward compared with a tested thermometer, by immersing them simultaneously in vessels of water at various temperatures, and was found to have a constant error of about half a degree within the range of temperatures recorded below. Corrections have accordingly been made in these readings before entering them in the tables. The thermometer read to degrees, and fractions of degrees were estimated. The length of one degree on the scale was such that for an eye trained in estimating fractions of lengths the error should in any case have been less than one-tenth of a degree.

I am indebted to Prof. Jacob Reighard for much assistance in discussing my data and in preparing this paper for publication.

III.—Rate of Chirping.

In producing the sound the wings are raised nearly at a right angle with the body, and then scraped firmly across each other. The sound is either a single chirp, or much more commonly a succession of chirps, which follow one another at regular intervals, and vary in number, in the cases observed by me, from 5 or 6 to 2,640. Six hundred to a thousand is the more usual number. The term "chirp," as used in the following pages, refers to a single element of such a series. If the rate of chirping is 120 per minute, the chirps occur at intervals of half a second. I have estimated that one-third of this time, or one-sixth of a second, is occupied in producing the sound, while the remainder is the period of silence between chirps. If the rate is only 60 per minute, the time occupied by the sound is one-third of a second. The rate of sound vibration in this case is much slower, and the pitch is correspondingly lower.

a.—Effect of Temperature on Rate.

From the hundreds of observations made, a representative group is shown in Table I. The temperatures are those at an elevation of six feet, the average elevation of the insects. The temperature at two feet elevation was generally about half a degree lower, that at ten feet half a degree higher than that at six feet elevation. The temperatures computed from Dolbear's and Bessey's formulas are added for comparison.

Table I.—Showing rates of chirping of various individuals of *Œcanthus niveus* at different temperatures and elevations :

Date.	Number of chirps per minute, individuals of *Œcanthus niveus*.	Elevation of individual above ground, in feet.	Temperature in degrees Fahrenheit.		
			Computed from Dolbear's formula.	Observed at elevation of six feet.	Computed from Bessey's formula.
Aug. 22...	144	—	76.0	75.8	71.06
Aug. 23..	156	6	79.0	74.9	73.62
Aug. 24..	174	6	83.5	78.8	77.45
Aug. 27..	93	6	63.25	60.4	60.21
Aug. 28..	82	4	60.5	61.5	57.87
	93	2	63.25		60.21
	96	2	64.0		60.85
Sept 7....	100	3	65.0	69.9	61.70
	102	8	65.5		62.13
	110	10	67.5		63.83

It is seen that there is a general correspondence between rate and temperature. But that the rate does not follow any law based on temperature is apparent from the observations for Aug. 27 and Sept. 7 (first record), where the rates are the same with a difference of temperature of over nine degrees. Furthermore, comparison of Aug. 27 and Aug. 28 shows that of two records the higher rate may accompany the lower temperature. The five records for Sept. 7 were made within an area of two square rods in the same blackberry patch. The crickets were chirping simultaneously, and the observations were made within a period of 15 minutes; the temperature did not change perceptibly, yet the rate in different individuals is from 93 to 110. Other records made outside of this area on the same evening showed even greater extremes, the lowest rate being 84 per minute, the highest 126. These observations are of interest in the light of Dolbear's observation of accurate synchronism.

It will be noted that the crickets of Sept. 7 were at different elevations, and that those at the greater height chirped the more rapidly. While there were numerous exceptions to this correlation of rate with elevation, the higher crickets chirped at rates which on the average were markedly higher than the average of individuals nearer the ground. Dolbear might have explained this difference of rate at different elevations by the fact that the greater elevations have the higher temperatures. Even if temperature is the cause of the variations at different altitudes, the synchronism existing among "all the crickets in a field" would be destroyed, for to produce such synchronism it would be necessary to have, not merely a level field, but all the crickets in the same horizontal plane over the field. Granting for the moment that temperature alone is responsible for these differences in rate, Dolbear's formula, which is not much in error in making the rate increase by 4 per degree rise in temperature, does not state the proper relation between the difference of temperature and the difference of rate. The observed difference of temperature between elevations of 2 ft. and 10 ft. was usually about 1° at the time of making these observations, 7.30 to 8 p.m. Hence, according to Dolbear's formula, or any formula based on crickets at the same elevation, the difference in rate between elevations of 2 ft. and 10 ft. should have been about 4, whereas it will be seen from the table that the difference was 17.

Evidently individual rates are not closely correlated with temperature. If any accurate correlation exists, it ought to be apparent from average rates. A few averages, covering, with some additions, the same period

as in Table I, have been calculated, and are given, together with the temperatures computed from Dolbear's and Bessey's formulas, in Table II.

Table II.—Showing averages of the rates of ten to fifteen individuals of *Œcanthus niveus* at different temperatures :

Date.	Average number of chirps per minute of 10 to 15 individuals of *Œcanthus niveus.*	Temperature in degrees Fahrenheit.		
		Computed from Dolbear's formula	Observed, taken at 6 ft. elevation, in middle of series.	Computed from Bessey's formula.
Aug. 22...	147.20	76.80	75.8	71.74
Aug. 23.	148.75	77.19	74.9	72.07
Aug. 24.	168.60	82.15	78.8	76.30
Aug. 27...	85.71	61.43	60.4	58.66
Aug. 28.	84.20	61.05	61.5	58.34
Aug. 29.	119.16	69.79	68.2	65.78
Sept. 1 ...	104.40	66.10	67.0	62.64
Sept. 7 ..	102.30	65.58	69.9	62.19
Sept. 8....	104.68	66.17	70.9	62.70

Here it appears again that, even when averages are taken, approximately equal rates may accompany widely-differing temperatures (cf. Sept. 1 and Sept. 8), and that the higher rate may occur with the lower temperature (cf. Aug. 27 and 28), though in both cases the discrepancy is less marked than in Table I.

It seems that while there is a general agreement between temperature and rate of chirping, yet it is not possible to express this agreement by any formula. Any temperature calculated from the rate by Dolbear's formula may be over six degrees in error, and over nine degrees when Bessey's formula is used. It follows also from these observations that there can be no accurate synchronism.

b.—Effect of Wing Length on Rate.

In attempting to explain the discrepancies noted above, wing length suggested itself as a possible factor. The effect of wing length was determined as follows : The rates of a number of individuals, say ten or fifteen, were determined, usually within a period of 40 minutes, and the average was computed. One member of the series, whose rate was of course known, was captured, and its wings were measured. Measurement was made by laying the wing, after removal from the body, on a scale

graduated to fifths of millimeters. By use of a lens these divisions could easily be divided to fourths, that is, to twentieths of a millimeter, so that the error in any case should have been within half this amount, or less than 0.025 mm. The captured specimen was taken from the middle of the series, in order to obviate any error due to a fall of temperature while the observations were being made. Sixteen such series were recorded, and consequently sixteen wing measurements were made. The results of these measurements are given in Table III. The quantities in the fifth column are found by dividing those in the third column by those in the fourth.

Table III.—Showing the length of wing of individuals of *Œcanthus niveus*, the rates of chirping of these individuals, and the average rates of other individuals at the same time :

No.	Length of right wing in millimeters.	Number of chirps per minute.		Ratio of individual rate to average rate.
		Of individual in middle of series.	Average of entire series.	
1	12.93	109	111	.982
2	13.18	136	135	1.007
3	13 25	111	112	.991
4	13.13	151	153	.987
5	13.10	111	111	1 000
6	13.02	67	68	.985
7	13 84	140	139	1.007
8	12.28	137	138	.993
9	13.05	114	111	1.027
10	13.27	132	134	.985
11	12.65	112	111	1.009
12	12.91	149	150	.993
13	13.48	112	111	1.009
14	12 70	134	137	.978
15	13.24	131	131	1.000
16	13.22	157	153	1.026
Average . . .	13.08			

If, now the wing-lengths and the ratios of the individual rates to the average rates be plotted as ordinates and abscissæ, respectively, they should group themselves in some noticeable fashion about an oblique line, provided there is any correlation between wing-length and rate of stridulation. But no such grouping is apparent (fig. 14). Particularly

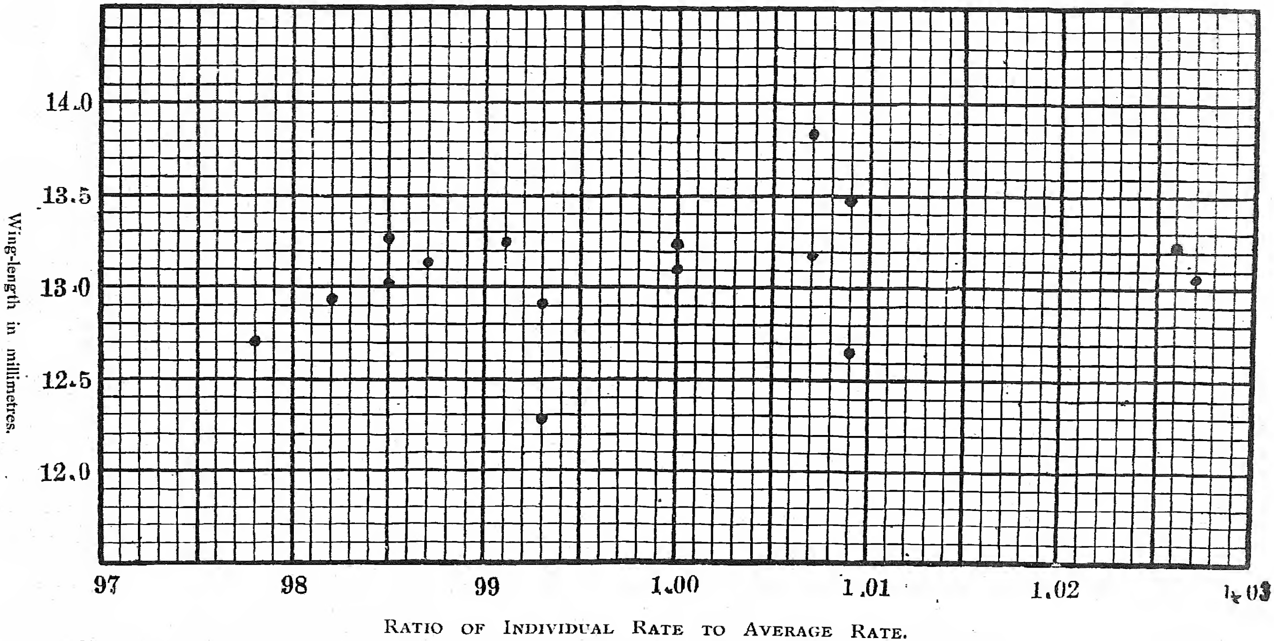


Fig. 14.—Graphical representation of the wing-length and ratio of individual rate to average rate for sixteen individuals of *Œcanthus niveus*. Data from Table III.

instructive should be Nos. 7 and 8, representing the extremes of wing-length. In neither case is the deviation from the average rate as marked as in some cases where the wing-length is more nearly the average, for example, Nos. 4 and 9.

c.—Effect of Humidity on Rate.

As I was not properly equipped with apparatus, I have no conclusive evidence of the effect of humidity. But the results of two sets of observations made on the same evening, under different conditions, point to a probable influence of humidity. The first observations were made under a clear sky, and with no perceptible air currents. Dew was forming near the ground, showing that the vapour was saturated there, while higher up the bushes were dry. The second set of observations was made nearly two hours later, when there were light winds and it was beginning to rain. At this time the vapour must have been saturated at all elevations. Hence the humidity had remained constant near the ground, but had risen noticeably at greater elevations. During the two hours the temperature at an elevation of 6 ft. had fallen 1°.6. The decrease at 12 ft. was probably about 2°.2. The crickets observed were in precisely the same locations in both sets of observations, and were probably the same crickets. The rate of chirping of those near the ground had decreased 5 or 6 per minute, that at 12 ft. had decreased 20 per minute. Change in temperature alone accounts, according to Dolbear's formula, for a decrease of but 9 in rate. It is possible to explain the further decrease at the higher elevation by supposing that increase of humidity diminishes the rate of stridulation. This supposition will also explain part of the difference in rate noted between crickets at elevations of 2 ft. and 10 ft. on Sept. 7 (Table I), since the humidity is greater near the ground.

d.—Effect of Individuality on Rate.

As I did not find external factors to explain satisfactorily all the observed facts, I was led to look for internal factors. Of these internal factors, individuality and physiological state suggested themselves. By individuality is meant that constitutional peculiarity which results in a constant difference between one cricket and its fellows. The constant difference was frequently one of pitch. Certain crickets, while maintaining approximately the same rate, were found to chirp at a constantly lower pitch than other crickets in similar locations. Again, some crickets possessed a peculiar variety of chirp, one of which is later to be mentioned specifically, and this peculiarity was present in every chirp. If it should be found that each individual, while varying its rate with the temperature

or other external conditions, at the same time shows individual peculiarity in rate, so that under the same conditions the rate is constantly higher or lower than that of other crickets, this constant peculiarity might be referred to as "rate individuality."

To determine whether individuality affects rate as I found it to affect pitch and quality of chirp, several crickets were confined in the house. But they rarely chirped, and then for but a short time. Outside in the yard and fields it was found that chirps issued from the same point in the bushes evening after evening. Sometimes these chirps possessed peculiarities of pitch or unsteadiness which were different from those of almost any other cricket. When these peculiarities occurred in the same place for several successive evenings, I assumed that they were produced by the same cricket. The data given in Table IV are from one such cricket, whose distinguishing peculiarity was an interrupted chirp, accentuated at the beginning and end as if the wings were then pressed more firmly together, so that the chirp sounded almost as if divided in the middle.

Table IV.—Showing rates of chirping of same individual of *Œcanthus niveus* over a period of thirteen days :

Date.	Number of chirps per minute of the same individual of *Œcanthus niveus* on different days.	Temperature in degrees Fahrenheit.	
		Observed.	Computed from Dolbear's formula.
Aug. 23....	149	74.9	77.25
Aug. 24....	167	78.8	81.75
Aug. 27....	80	59.9	60.00
Aug. 28....	80	61.5	60.00
Aug. 29....	109	68.2	67.25
Sept. 1.....	105	67.0	66.25
Sept. 2.....	149	76.0	77.25
Sept. 4.....	100	65.8	65.00

These data, together with data secured in like manner from two other crickets, are graphically represented in fig. 15. The straight solid line is the representation of Dolbear's formula. The other solid lines, A and B, are from two crickets that were observed over nearly the same period of days, one cricket being that referred to in Table IV. The two crickets were at nearly the same elevation and in similar locations, so that external conditions were practically identical. The dotted line is the curve for a cricket observed over a different period of time.

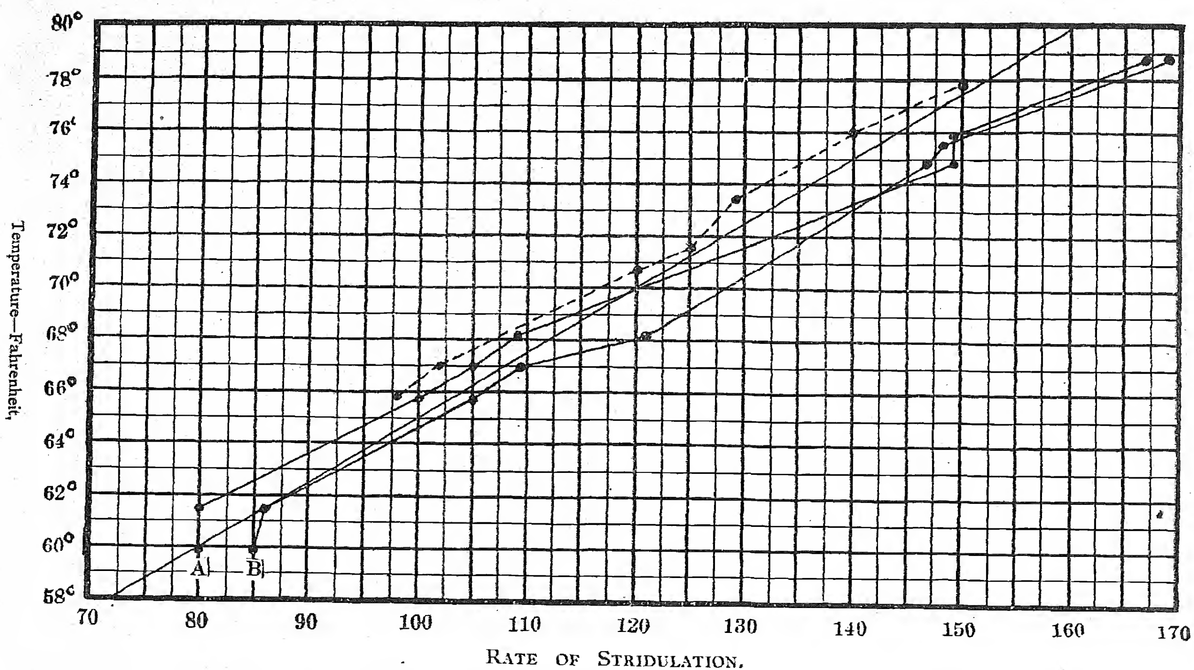


Fig. 15.—Graphical representation of temperature and rate of chirping of three individuals of *Œcanthus niveus.* The curve A is that of the cricket referred to in Table IV, observed from Aug. 23 to Sept. 4, 1906; B an individual observed from Aug. 22 to Sept. 4, and the dotted curve, one observed from Sept. 1 to 11, 1906.

The table of the rate of chirping of the individual cricket shows that the rates of even an individual are not closely correlated with temperature. In fig. 15, the fact that one of the solid lines lies, throughout the greater part of its length, above the other shows that the rate of one cricket is almost constantly higher than that of the other. This can hardly be explained except by individuality. The crossing and recrossing of the two lines must then be explained by another factor (physiological state) which I discuss in another place.

IV.—Synchronism.

I found exact synchronism to be comparatively rare, and to exist only between neighbouring crickets. When accurate synchronism did occur, it affected usually only two individuals, sometimes three. One evening I discovered two crickets about five feet apart chirping in such accurate unison that I did not at once realize that there were two crickets. One soon stopped ; the second hesitated, its chirp became weak, and it even lost a beat. After an irregular solo of several minutes, the second cricket recommenced. At the first chirp the first cricket struck a note out of time, then lost a beat, as if startled. It next voiced a half-dozen weak, uncertain chirps, then the call gradually grew in intensity, until the two crickets were again chirping in exact unison.

V.—Summary.

1. While there is a general correspondence between temperature and rate of stridulation, there are numerous variations of rate that cannot be accounted for by differences of temperature. Dolbear's formula cannot be applied to my observations without a possible error of 6°.65.

2. Rate of stridulation is in no way correlated with wing-length.

3. Humidity seems to affect rate of chirping, but the evidence is not conclusive.

4. The rate of chirping of different crickets under the same external conditions depends on their individuality.

5. Synchronism is rare, and is observable in only two or three individuals near one another.

VI.—Discussion.

It is clear that Dolbear's and Bessey's laws are only approximately accurate. Temperatures computed from them may be expected to vary from observed temperatures as much as 6°.65 with the first formula, and 9°.69 with the second. Any expression for the rate of chirping must be a function of several independent variables, of which temperature is only

one. Hence, its graphical representation is not a line, nor even a surface. Of the other possible factors in addition to temperature, it has been shown that wing-length is of no effect in determining the rate of chirping. The remaining two factors which have been studied, namely, humidity and individuality, are, with temperature, sufficient to explain most of the observed facts. However, in fig. 15 there remains still one point to be explained. That point is the crossing of the curves of the individual crickets. The external factors of temperature and humidity have been eliminated by having them practically the same for both crickets. Individuality has not served to keep the curves separate throughout their length. Here some other factor, either external or internal, must enter. The most plausible explanation seems to be that based on differences of physiological state, which, of course, could not be determined from my observations. It is quite possible that physiological condition (age, hunger, sexual condition, etc.), plays an important role. It may well so have affected "rate individuality" as to have caused the crossing of the two curves plotted in fig. 15.

The synchronism found by Dolbear does not appear in my observations. As a rule, even neighbouring crickets chirp at rates that are very noticeably different. The instance of synchronism recounted above throws some light on the question, which by implication Edes (1899) raises, as to whether synchronism is due to the effect upon various individuals of equal temperatures or other conditions. It seems from my observation that synchronism may possibly be due rather to the effect of each cricket's chirp upon the other cricket.

Dolbear may have gained his impression of universal synchronism by observing a sporadic case of it or by actually listening to but one cricket and mistaking it for a full chorus. The intensity of sound diminishes so rapidly with increasing distance from the source, that with but one cricket chirping several feet away and the others at a greater distance an observer could easily overlook those at the greater distance. One cricket, if undisturbed, will usually perform six to eight hundred chirps without missing one, except on cool nights. Not infrequently it will perform 1,500 in succession; while one "long-winded" individual which I observed continued through 2,640, another 2,425, a third 2,228. From these figures it will be seen that breaks in the series of chirps might escape observation, and that the continuous chirping of one performer might be mistaken for a chorus in which the single crickets were not missed when they dropped out. It would thus happen that a single cricket may have been mistaken for several in unison, each performing less continuously.

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TWO UNDESCRIBED WATER BUGS FROM THE UNITED STATES.

BY J. R. DE LA TORRE BUENO, NEW YORK.

If one takes up any of the authoritative text-books of entomology, especially such as refer to the Eastern United States, one will find that in certain of the families of the so-called Cryptocerata the Eastern American species rarely exceed two or three in as many genera. Such, for instance, is the case with the *Nepidæ*, for which only two species are given; the *Gelastocoridæ*, which is stated to have but two or (counting Ochterus as in the family) three species in as many genera. A more pertinent example is the family *Naucoridæ*, of which there is only one species known on this side of the continent; to this I add another, *Pelocoris Carolinensis*, mihi, described hereafter. The *Notonectidæ* have fared better, and the five thus far known are increased to six for the Eastern United States. Both these additions are due to the assiduous labours of Mr. C. S. Brimley, to whom I am grateful for many very interesting things noted elsewhere.

Family NOTONECTIDÆ, Genus NOTONECTA, Linné.

Notonecta Raleighi, nov. sp. = *N. variabilis*, partim, Bueno. J. N. Y. Ent. Soc., xiii, p. 155.

Head.—Notocephalic lateral margins nearly straight; vertex more than six times as wide as synthlipsis; base of eyes over four times as wide as synthlipsis.

Pronotum two-thirds broader than long; base and lateral margins nearly straight, humeral margin sinuate. Scutellum one-quarter broader

than long, sides pronouncedly sinuate, caudal angle long. Hemelytra little longer than the body, moderately clothed with a silvery pubescence on the clavus and corium; membrane lobes unequal. Abdomen luteous, fringing ciliæ black, sparse. Pedes luteous; intermediate femoral spur concolorous, long, thin and sharp.

Coloration.—Eyes dark reddish-brown. Cranium and prothorax whitish. Scutellum ranges from pure light yellowish to black, disk margined with smoky orange-yellow on the hemelytral margins. Hemelytra ranging from white with vague beginnings of the corial fasciæ and black humeri with white membrane, through all intergrades to a form with a blackish stripe along the anterior margin of the corium; black margins to the clavus along the scutellar edges; a blackish streak along the corium near to and parallel to the claval suture; black corial fasciæ merging into the black membrane, which shades off into smoky and then white at the apex. One of the types is the most pronouncedly melanic specimen of the species in a series of 60 or so specimens. In this the extreme of scutellar darkness with orange-red edges obtains. The external edges of the clavus are broadly black, shading into smoky to the corial suture; the dark band on the corium parallel to this suture is broad; the humerus has a black streak running into the corium, which is dark luteous, except for the black fasciæ which coalesce with the black membrane, which in turn lightens to smoky at the apex. The structural characters are the same as in the others.

Measurements.—Vertex, 1 mm.; synthlipsis, .15 mm. Pronotum, long., 1.5 mm. to 1.8 mm.; pronotum, lat. (at humeral angle), 2.5 mm. to 2.9 mm., (at base) 2 mm. Scutellum, long., 1.6 mm.; scutellum, lat., 2 mm. Insect., long., 8 mm to 8.8 mm.; insect, lat. (at humeral angle of pronotum), 2.5 to 2.9 mm.

Described from sixteen specimens from Raleigh, N. C. Types: Collections U. S. National Museum, American Museum of Natural History, C. S. Brimley, and mine.

This species very much resembles a dwarf *variabilis*, but it is easily distinguishable by the cephalic structure. It comes in section 7 of my table for the separation of species,* which may be varied as follows to include it:

7. (1 and 10) Small slender species.
8. (9) Vertex three times the synthlipsis, etc, etc. . . *variabilis*, Fieber.
9. (8) Vertex more than three times the synthlipsis.

*See Journal N. Y. Ent. Soc., xiii, p. 149.

10a. (11a) Vertex six times the synthlipsis; width of pronotum one and two-thirds times the length; width of scutellum one and one-quarter times the length; length of insect, 8 to 8.8 mm . . . . *Raleighi*, n. sp.

11a. (10a) Vertex six to eight times synthlipsis, etc., etc. *Uhleri*, Kirkaldy.

This species is locally abundant at Raleigh, N. C., and I also have it from Delair, N. J. (W. P. Seal); Chicago, Ills. (V. E. Shelford); Running Lake, Mississippi River Bottoms, Ills. (Prof. C. A. Hart); Bladensburg, Md., and Washington, D. C. (O. Heidemann). The Washington and Bladensburg specimens I had placed in *N. variabilis* in my revision of the genus cited above, taking them, as noted, for dwarf specimens of the latter species, but a larger series showed unmistakably that it was a different species.

Family NAUCORIDÆ, Genus PELOCORIS, Stal.

Pelocoris Carolinensis, n. sp..

Head.—Broader, including eyes, than long; front more or less remotely punctuated and furrowed; width at base and at widest part subequal; eyes longer than wide, greatest width about one-third from the distal end; sinuate in the inner margin, converging toward the distal end more than toward the proximal end. Labrum broader at base than long; triangular in shape, with rounded apex attaining the middle of the third segment of the rostrum. Rostrum short, stout.

Pronotum about 2⅓ times as broad at base as long along the median line; broader at base than at distal margin; both basal and distal margins more or less sinuate; edges curved regularly from the eyes to the humeral angles, which are rounded; disk with indented lines behind the head, parallel to the anterior margin, the first line as long as the distance between the eyes, and diminishing in length posteriorly, giving an obtusely triangular shape to the lined area, the remainder of the disk coarsely punctuated, caudad of the pronotal suture it is shagreened in wavy lines.

Scutellum about twice as broad as long along the medial line; apex blunt; sides sinuate, shagreened.

Hemelytra narrower than abdomen, but extending to end of same. Membrane distinct, but merging insensibly into the corium. Embolium flattened and broadened marginally, extending beyond the abdomen. The three last connexival segments have prominent posterior angles. Entire hemelytra, including the membrane, covered with very short, sparse golden hairs. Mesosternal keel slightly raised, grooved longitudinally with hairs arising on either side, and nearly covering the groove.

Abdomen.—Genital segments prominent in male, flattened and cleft in female. These segments are somewhat complicated, and no adequate description can be made without a dissection.

Pedes.—First pair raptorial with incrassate femora grooved for the reception of the tibiæ, which are curved and furnished with a one-jointed tarsus, destitute of claws. Second and third pair cursorial, with normal femora and tibiæ, with two-jointed tarsi, armed with moderately long, slender claws. The tibiæ are furnished with moderately long spines in two rows.

Coloration.—Head flavous, with a dark median line of varying width, sometimes reduced to a triangle at the vertex, and at others entirely absent or very faint. Prothorax also flavous, the punctuations of the disk brown, the flattened outer margin much lighter in colour; the area caudad of the suture, more or less variegated with perpendicular black lines of varying widths. Scutellum brown, the apex sometimes lighter in colour, approaching to flavous; some individuals have lighter vermiculations in the disk. Hemelytra also brown, with lighter vermiculations, the ground colour of varying shades; the darker forms have two flavous spots on the corium at the edge next to the membrane, which disappear in the lighter forms. The embolium is testaceous, darkening caudad. The connexival segments are black posteriorly. The abdomen varies from testaceous to dark brown. The legs are concolorous except the spines, which are darker and black-tipped; the anterior legs are flavous, except the apex of the tarsus, which is dark. Labrum flavous; terminal segment of rostrum darker at the lip.

Measurements.—Head, ♂, long., 1.5 to 1.7 mm.; lat., 2.6 to 2.9 mm. ♀, long., 1.8 to 1.9 mm.; lat., 2.8 to 3 mm. Pronotum.—♂, long., 1.7 to 2 mm.; lat., 4 to 4.6 mm. ♀, long., 1.9 to 2 mm.; lat., 4.5 to 4.7 mm. Scutellum.—♂, long. (measured from prothoracic groove), 1.3 to 1.4 mm.; lat., 2.3 to 2.7 mm. ♀, long., 1.4 to 1.5 mm.; lat., 2.7 to 2.9 mm. Insect.—♂, long., 8.2 to 9.3 mm; lat., 5 to 5.5 mm. ♀, long., 9.3 to 9.6; lat., 5 6 to 6.1 mm.

Described from 8 males and 8 females taken by Mr. C. S. Brimley, at Lake Ellis, Havelock, N. C., and two carded specimens from Blanfort, S. C., in the American Museum of Natural History collections. Types in U. S. National Museum (♂ and ♀), American Museum of Natural History (two carded specimens mentioned above), collection C. S. Brimley (♂ and ♀), and my collection.

This bug differs from the species recognized as *Pelocoris femoratus*, Pal., Beauv., in its smaller size, more slender shape, the cleft female genital segment, the more densely punctate and stouter prothorax, and the more noticeably flattened prothoracic margins. Mr. Brimley says of this water-bug*: "Among the Hemiptera the only form of note was a Naucorid, which fairly swarmed in the lake among the water-weeds." The lake referred to is Lake Ellis.

*Ent. News, xvii, No. 3, p. 85, March, 1906.

ON THE GENUS *RULANDUS*, DISTANT, (HEMIPTERA).

BY G. W. KIRKALDY, HONOLULU, HAWAIIAN ISLANDS.

Rulandus, Distant (1904, Faun. Ind. Rh., II, 391), is described as a Nabid, but it is most certainly not, as it has neither the facies nor the characters of that family. It is a Reduviid, and judging from the figure and description is probably a Reduviine proper (Acanthaspidine).

STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

III.—INCISALIA HENRICI.

(Continued from page 187.)

Incubation.—Of the thirteen eggs secured from the female confined over *Vaccinium*, seven were left on the growing plant and in the open air to develop under natural conditions; the other six were brought into the laboratory. When first laid the egg is pale green, showing under a low power of the microscope the large white bosses studding the surface except on the flattened top and bottom. As the larva develops within the shell the latter becomes glistening white, the caterpillar appearing but faintly through the nearly opaque pellicle.

On May 19th, between 7.30 p.m. and the next observation, the first egg (No. 1) hatched. When found at 10.30 p.m. the larva had deserted the empty shell and was feeding on a bud, the food showing through the dorsum as a dark green line. A small hole was visible at the edge of the circum-micropylar area of egg No. 3 (laid on *V. corymbosum*), and at 11.12 p.m. the caterpillar, having eaten away the whole top of the shell, emerged. Shortly afterward Nos. 2, 4 and 5 were punctured, and the larvæ emerged almost simultaneously at midnight. No. 6 did not hatch until 9.30 the next morning.

The eggs left out of doors did not develop so rapidly; Nos. 7, 8, 9 and 10 hatched during the early morning, and No. 11 about 5 p.m. on May 21st. The larvæ in Nos. 12 and 13 developed normally, but died within the shell.

The period of incubation, therefore, varies from 4 days 7 hours to 6 days 4 hours. Edwards gives as the "duration of this stage five or six days."

The Larval Stages.—Following are the tabulated records of the larvæ which lived long enough to make the determined facts of any value. The

terms and the use of the asterisk are the same as I employed in outlining the life-history of *I. augustus* (see CAN. ENT. for July, 1906).

EGG.	No. 2.	No. 3.	No. 5.	No. 6.
laid	*2.05 p.m. May 15	*2.12 p.m. May 15	*2.16 p.m. May 15	12.40 p.m. May 15
hatch'd	*12.01 a.m. May 20	*11.12 p.m. May 19	*12.01 a.m. May 20	*9.30 a.m. May 21
FIRST MOULT—				
UP	7.30 p.m. May 22	7 p.m. May 25	2 p.m. May 23	4 a.m. May 25
OFF	*8.30 p.m. May 24	4 a.m. May 26	*noon May 25	4 a.m. May 26
SECOND MOULT—				
UP	10 a.m. May 27	1 p.m. May 29	*8 a.m. May 28	9 p.m. May 29
OFF	4 a. m. May 29	*6.05 p.m. May 30	4 a.m. May 31	*11 p.m. May 31
THIRD MOULT—				
UP	6 p.m. June 1	4 a.m. June 2	not	*5.32 p.m. June 3
OFF	5.30 p.m. June 3	9 p.m. June 4	observed	11 p.m. June 4
PUPATION—				
FINAL	8 a.m. June 10	killed	2 p.m. June 9	noon June 10
PUPA	*9.34 p.m June 11	for study	*11.10 p.m. June 10	*10.22 p.m. June 11

The larval stages of this species were worked out by William Henry Edwards with such careful accuracy that little remains for me to do beyond paying tribute to the character and quality of his work and verifying the facts published in Papilio (Vol. I, p. 150-152), a quarter of a century ago. However, since I have had the exceptional good fortune of breeding the larvæ side by side with those of *irus*, *augustus* and *niphon*, I venture to hope that my observations will be of added value by reason of the comparisons thus made possible.

First Stage.—The caterpillar begins life in the generalized form described by Edwards thus: "Length, 4-100 inch; shape, oval; broadest anteriorly, the base flattened; dorsum high and sloping posteriorly; the summit of dorsum flattened for a little space, and on either side there is a row of long recurved white hairs; along edge of base is another row of similar hairs bent down; colour brownish-yellow; head obovoid and smooth." I may add that the head is brownish-yellow, with rich brown mandibles and labrum, and the short dusky bristles associated with the laterodorsal series of hairs are present. Without careful examination with a microscope the new-born larvæ are indistinguishable from those of *irus* or *augustus*.

The Succeeding Stages.—As Edwards has pointed out, the coloration has altered considerably by the time the first moult is passed. The general colour is light green, with markings distributed as in *irus* and *augustus* (when mature), these markings of a yellow-green, not the intense yellow-green of *augustus*, but of a tint that may properly be described as "flat," and lacking in brilliancy. On either side of the faint (and not always present) mediodorsal yellow-green stripe the dorsal blood-vessel shows *dull red-brown.* Moreover, all the body-green (*i.e.*, all excepting the mediodorsal stripe, the summits of the laterodorsal ridge, the oblique lateral dashes—in *Henrici* run in with the laterodorsal marks and not distinguishable from them—the spots which represent the vestige of a spiracular line, and the stripe on the substigmatal fold, all of which are markings due to modification of the tissues)—with the exception then of these markings *the whole upper part of the larva may be a deep red-brown.* There are all degrees of intergrading between the two extremes, *but the dorsal stripe was red-brown in all of the larvæ carried through to the second stage.* As no such colour appeared in any of the hundred-odd *irus* or in any of the six *augustus* examined, it is probably a reliable diagnostic character for this stage, and as it persists throughout larval life, for the subsequent stages also.*

The more elongate shape and the *prominent* ridge on each of the first eight abdominal segments differentiate the larva of *Henrici* from the congeneric caterpillars without reference to coloration, though the differences in the latter respect are more striking, *irus* being *pale pea-pod-green*, with faint white or very light green markings, *augustus vivid* yellow-green, with (or without) *bright* yellow markings, and *Henrici* dark green or "*port-wine-red*," with broad, prominent markings of a *dull, flat* yellow-green. These points will be discussed and illustrated later.

Larval Variation.—In the spring of 1881 Mr. Edwards found his first caterpillar of this species feeding on a wild plum. It was nearly full-grown, and eventually became a chrysalis which did not disclose the imago. It was described as having been "entirely green in shades, *except for two subdorsal red-brown stripes.*" The following year eggs were secured from an imprisoned butterfly, and one larva was bred to maturity on plum; when full-grown it differed from the other caterpillar in that the

*The dorsum is red in *I. polios* during the second larval instar, but other characters make the separation of *Henrici* and *polios* a simple matter.

darker green (the ground colour) was almost completely replaced by "port-wine-red," leaving the lighter yellow-green in strong contrast. Because the larvæ were of the same size and shape, fed upon the same plant and yielded similar pupæ, Mr. Edwards was led to believe that they were varietal forms of the same species. His suggestion that "possibly, in raising a brood of these caterpillars at some future time, both red and green ones will be found among them," is tantamount to a prediction. Such proved to be the case. Of the four larvæ which were raised by me, one fitted the description of "the caterpillar of 1881" (green) to a nicety; a second corresponded in every detail to the "port-wine-red" caterpillar (of 1882), and of the two others one was intermediate between these, and one became eventually even more completely red than the red one of Edwards.

Feeding Habits.—The habits of the caterpillar when feeding on plum have been described; they do not differ essentially when *Vaccinium* is the food. When young the larvæ will eat the floral organs, but by the time the second moult is reached these have disappeared and the green fruit is eaten. A tunnel just large enough to accommodate the head is made in the side of a berry, and as the mandibles work this deeper and deeper the "collar" is brought up flush with the surface of the fruit, much as a man's sleeve would come against a fence if he attempted to force his arm through a small hole therein. This gives the caterpillar the appearance of being half-way into a berry not large enough to hold the half.

The larvæ will often remain motionless (apparently) for many hours at a time, and do not evince any great desire to wander from a fruit-cluster until all the edible pulp has disappeared. My "very red one" (No. 5), when nearly mature spun a little silk on a pedicel, and after firmly fixing his anal prolegs to the mat proceeded to clean out all the food within reach. It devoured the interiors of five berries in about eight hours without releasing its hold on the mat. In order to do this it was twice necessary to maintain an exceedingly awkard position. Having finished up these five it moved the fore part of its body in all directions, until it came in contact with the lowest fruit on a cluster above, and into this it promptly bored. As long as watched (about 25 minutes) it fed in this unusual position, stretched to its full length, with only the anal prolegs and the true legs touching the plant. When next observed it had released its hold on the lower cluster.

Food-plants.—Though we have every reason to believe from the facts as given that *Vaccinium vacillans* is a natural food-plant, I am not satisfied that it is the only local food-plant. I have spent many hours, both of daylight and at night, in the search for *augustus* larvæ on the same plant, and have never yet found a caterpillar of *Henrici*. Mr. Edwards's discovery of a full-grown larva on wild plum suggests that other species of *Prunus* may be the food, and this is borne out by the coloration of the insect, which renders it very conspicuous on a green surface, and the rosy tints here and there on *vacillans* are altogether too ill-defined to make it any the less so on that plant. Although wild plum is not found hereabout, *Prunus pennsylvanica* and *P. cuneata** are common, and are likely to prove the usual food-plant locally.

I was unable to secure any wild plum, or I should have tried my larvæ with it; they would not touch cultivated varieties when *Vaccinium* was to be had, and I did not risk losing them by removing the latter from the breeding-glasses.

Pupation.—When ready to pupate the caterpillar descends from the plant and turns to chrysalis among the twigs and dried leaves on the ground. When from their actions it became evident that my larvæ had finished eating, they were placed in a box with a plentiful supply of rubbish, among which there chanced to be an old alder leaf caked over and nearly black with dried "honey-dew." This was found by all three caterpillars, and on the lower surface (as it lay) they took their stations preparatory to casting the last larval skin.

The Change to Chrysalis.—I witnessed the ecdysis of the chrysalis of all of the three insects which pupated, though the greater part of the precursory peristalsis took place during my absence. The skin split first along the thoracic dorsimeson, and was more or less torn as the soft pupa worked its way out. The latter was dingy gray-green on the wing-cases and abdomen ventrally, dusky orange-brown on the dorsum. The series of pits (distributed as in *augustus*) were not as marked as would have been expected from the deep foveæ of the larva, the pigment in them was dark brown instead of black, and appeared to be absent in some. By morning the chrysalids were brownish-yellow, sprinkled with pitchy spots, the pits scarcely noticeable, the straw-coloured spiracles standing out in sharp contrast. During the succeeding 24 hours the skin became steadily darker, the spiracles remaining light until the final coloration was attained.

*Recently separated from *P. pumila* according to Britton and Brown.

The Chrysalis.—Distinguished at once from the chrysalids of *irus*, *augustus* and *niphon* by its squat, compressed appearance, the abdomen being relatively stouter. This may be readily seen by comparing the figures (1, 2 and 3) in plate 5 with the figures of *irus* and *augustus* pupæ given in Vol. XXXVIII, No. 6 (June, 1906) and plate 3 of the current volume (May).

Ground colour warm orange-brown, marked with very dark brown, as follows: Each abdominal segment with a moderately large mediodorsal blotch crowded toward the posterior incisure; a larger supralateral area from just above the spiracle to a point somewhat dorsad of the lateral pit, extending the entire width of the segment and including the lateral and infra-lateral pits, which are black; a rudely-triangular infra-stigmatal spot, largest near the posterior incisure, tapering forward; on the ventral surface of those segments not covered by the wing-cases a few scattered, minute spots. The metathorax and sides of the mesothorax are of the same deep brown (in a strong light burnt-sienna), leaving the orange-brown as an irregular mediodorsal streak. Prothorax with an obscure dark transverse stripe near the posterior incisure, and a mediodorsal slender line of the same colour. Face and wing-covers very dark from the many crowded small spots. Spiracles very noticeable, each bright yellow, set in an orange-brown area, except the thoracic. Prothorax with a delicate medial "ridge." Described from three specimens showing scarcely any variation.

Were it not for the fact that the darker colour covering most of the surface has been determined to be due to the presence of pigment I should have spoken of this as the ground colour, and the smaller orange-brown areas as markings. Such a description would have been, perhaps, easier to apply in identifying the pupæ, but would not have been accurate in the use of terms.

Possible Correlation between Larval Characters and Sex.—Unfortunately the numbers affixed to the leaf beside each chrysalis became detached, and the suggestion offered here is based upon my memory of where the three caterpillars spun their final mats and the position of the numbers as they lay after having fallen off. I regret that it did not occur to me to sketch the larvæ as they rested upon the leaf. To the best of my knowledge and belief the *green* caterpillar yielded a larger pupa containing a female; the two *red* larvæ yielding smaller pupæ containing males. I shall endeavour to verify this with others now being bred.

NOTE ON I. POLIOS.

In the lower part of the plate are represented paratypes No. 23 (♂ under surface), No. 24 (♂ upper surface), No. 25 (♀ under surface), and No. 26 (♀ upper surface), of *I. polios*, described in the CANADIAN ENTOMOLOGIST for June, p. 202. It may be pertinent to state that the food-plant of *polios* has been discovered, eggs secured, and the larvæ now being raised have already passed the first moult. The specific validity of the form is no longer open to question.

NEW COLEOPTERA FROM THE SOUTHWEST.—III.

BY H. C. FALL, PASADENA, CALIF.

Pteroloma caraboides, n. sp.—Blackish-brown, moderately shining, legs and antennæ somewhat paler. Antennæ as usual. Head sparsely finely punctate. Prothorax 2/5 (♂) to 1/2 (♀) wider than long, widest at or slightly in advance of the middle, base a little wider than the apex, sides moderately rounded, oblique and just perceptibly sinuate posteriorly, hind angles sharply defined, but slightly obtuse; disk evenly, rather feebly, convex, median line not at all impressed, side margin acute and slightly reflexed, a feeble impression within the hind angles; surface finely, sparsely punctate, the punctures somewhat unequal in size, and becoming more numerous near the basal and lateral margins. Elytra elongate oval, a little wider at base than the prothorax, more than three times as long as the latter, and more than one-half longer than wide; sides arcuate, feebly sinuate before the apex, which is narrowly rounded; striæ strongly impressed, distinctly but not coarsely punctate; intervals very finely and sparsely punctulate, the alternate ones with a series of distinct and feeble larger punctures. Body beneath distinctly alutaceous, but shining and very finely, sparsely punctate. Epipleura minutely and sparsely punctate. Length, 6½–7 mm.

Wenatchee, Washington, collected by Prof. H. F. Wickham; Mt. San Antonio, So. California, a single example taken at an altitude of about 9,000 ft. by Mr. C. A. Richmond.

The male has the front tarsi quite strongly dilated, the first two joints of middle tarsi moderately so.

This species has the general form of *Forstrœmei*, but differs—judging from the description—in the more finely punctate thorax, with median line unimpressed, the much less distinct serial punctures of the alternate elytral

intervals, the nearly impunctate epipleura, and the more widely dilated male tarsi. According to Horn's description the sixth ventral segment is deeply longitudinally impressed in the female of *Forstræmei.* There is no sign of such impression in the female of the present species, though in the male of both this and *tenuicornis* the sixth ventral has a fine median impressed line. The resemblance of this species to *Bembidium spectabile* is quite striking.

Chrysobothris carmelita, n. sp.—Moderately elongate, feebly convex, piceous-bronzed; front (♂) green; occiput, front margin of pronotum narrowly, the front angles broadly, brilliant æneo-cupreous; elytral impressions more or less cupreous; beneath blackish, with faint green-bronze lustre, hind thighs æneo-cupreous in apical half. Front nearly flat, rather densely pubescent, uniformly densely punctate, occipital impressed line a little elevated anteriorly; clypeus with deep oval emargination, arcuato-truncate each side. Antennæ bronzed, greenish at base, narrowed externally, third joint barely as long as the two following. Prothorax one-half wider than long, widest close to front angles, sides thence convergent and straight except for a feeble median sinuation, nearly to base, becoming slightly inflexed at the hind angles; disk faintly impressed along the median line, and with a slight impression each side of the middle posteriorly; punctuation dense, with a tendency to form transverse strigæ laterally, especially near the angles. Elytra ¼ wider than the prothorax, and about 3½ times as long, very nearly twice as long as wide, basal and intra-humeral impressions well marked, a shallow rounded fovea just before the middle, and two others at apical third; inner costa distinct in apical half; second costa shorter, extending backward from the antemedian fovea; surface densely punctate throughout; side margin serrulate posteriorly, tips conjointly rounded with slight sectional sinuation. Prosternum lobed in front, densely punctate, and with rather long and dense white pubescence. Metasternum and ventral segments densely punctate at sides, less densely so at middle; pubescence abundant, and in well-preserved examples made more conspicuous by the presence of a white efflorescence. Length, 7¼–8¼ mm.

Arizona. Two examples are before me, one without definite locality, the other from Hot Springs, collected by Barber and Schwarz. Both examples are males, having the anterior tibiæ arcuate, and with a rather strong apical dilatation, above which the inner margin is distinctly notched

or impressed; middle tibiæ sinuate within and mucronate at tips, hind tibiæ straight; apical ventral segment broadly arcuately emarginate. One of the above examples has been in my collection many years, and was once submitted to Dr. Horn, who referred it doubtfully to *debilis*. It is, however, abundantly distinct from the latter by the dense punctuation of the entire upper surface, deeper clypeal emargination, brilliant colour of head and anterior margin of pronotum, form of prothorax, and other details. The front tibiæ of the ♂ in *debilis* are not emarginate above the dilatation.

Chrysobothris micromorpha, n. sp.—Elongate, not depressed, dark brown bronzed with traces of violaceous lustre on the anterior part of the pronotum and on parts of the elytra; front green (♂), vertex and occiput bright coppery-red; beneath piceous, faintly bronzed, tips of middle thighs and apical half or more of hind thighs brilliant coppery-red. Antennæ piceous, becoming bronzed at base, third joint much shorter than the next two united; outer joints gradually narrower. Front moderately convex, with conspicuous though not very dense white pubescence; punctuation moderately close and a little irregular, having a small smoother area each side of the median line, above which is a well-defined vertical chevron; clypeus broadly arcuately emarginate, sides subtruncate. Prothorax slightly less than twice as wide as long, sides subangulate at 2/5 from base, before which they are nearly straight and parallel, posteriorly straight and strongly convergent to base, which is narrower than the apex, and about 3/5 as wide as the base of the elytra; surface uniformly convex, without distinct impressions; punctures uniformly distributed, distant by rather more than their own diameter, and without tendency toward strigosity except very feebly near the hind angles. Elytra ⅔ wider than the prothorax, sides parallel and straight to about apical third, apex serrulate, surface without distinct foveæ except the basal ones; the inner costa feeble but evident toward the apex; punctuation similar to that of the pronotum. Prosternum rather strongly lobed in front, closely punctate anteriorly, a little less so posteriorly. Abdomen moderately punctate and pubescent, without lateral callosities. Length, 4½ mm.

Arizona. As in the preceding species, two examples are at hand, one without definite locality, the other taken at Hot Springs by Barber and Schwarz.

Both specimens are ♂'s, and have the front tibiæ slightly arcuate and dilated within at apex, middle tibiæ less arcuate, hind tibiæ straight; last

ventral truncate and broadly feebly emarginate, the outer angles of the emargination not dentiform. The side margins of the last ventral segment are evidently though feebly serrulate, and this, together with the absence of pronotal foveæ or callosities, places this species in Horn's Group I. It is most nearly allied to *piuta*, Wick., which should evidently be referred to the same group instead of Group IV, as stated by its author, but is still smaller—in fact, the smallest species of the genus known to me—and lacks the elytral foveæ, which are well defined in *piuta*. In this latter the coloration of the upper surface is more brilliant, the sides of the prothorax less narrowed posteriorly, and scarcely at all angulate, the third antennal joint longer and relatively narrower.

Chrysobothris pubescens, n. sp.—Moderately robust, dark bronze, shining, distinctly but sparsely pubescent throughout. Head coppery (♀), front green (♂). Antennæ narrowed externally, bronzed in ♀, greenish in ♂, third joint much shorter than the next two together. Front closely punctate, without or with but a small feeble callosity each side of the median line; clypeus with broad triangular emargination, lateral lobes rounded. Prothorax one-half wider than long, sides rounded in front and behind, parallel and slightly sinuate at middle; disk nearly uniformly convex except for a shallow impression on the median line anteriorly, callosities wanting, punctuation moderately close. Elytra one-third wider than the prothorax, not quite twice as long as wide, basal foveæ broad, not very deep; discal foveæ three in number, one before the middle, the other two at apical third, the outer one a little in advance of the inner, and sometimes connected with it, all the foveæ more or less cupreous or rarely greenish; costæ somewhat variable, the inner one usually distinct from basal third to apex; the second feebler, scarcely elevated, interrupted by the foveæ; punctures rather fine and well separated, at least at the middle of the disk; apices rounded and feebly serrulate. Prosternum lobed in front, closely and rather coarsely punctate, pubescent, scarcely differing in the sexes; ventral segments brightly bronzed, rather sparsely punctured at middle, more closely so laterally, and with more or less evident callosities. Front thighs with moderate acute tooth, which is denticulate externally. Length, 7½–9 mm.

California. Not rare in the Southern Sierras at altitudes of 3,000 to 6,000 ft., occurring most commonly on scrub oak.

In the male the tibial characters are the same as in the allied *deleta*, and the last ventral is very similarly subsemicircularly emarginate. In the

female of *pubescens* the last ventral has a much smaller emargination of nearly same shape as in the male, while in *deleta* (♀) the emargination is bisinuate. *Pubescens* is evidently broader and a little less convex than *deleta*, and—so far as my experience goes—may always be distinguished from the allied *deleta*, *deserta* and *lixa* by the anterior discal impression of the pronotum, which though slight is very constant, but is entirely lacking in the others. *Deleta* has a transverse series of four small callosities on the pronotum, the outer two often ill-defined. In *pubescens* these callosities are lacking, while in *deserta* they are larger and all four distinct. *Deserta* and *deleta* are very closely related ; in fact, one of the two examples of the former in the Horn collection is really *deleta*. This specimen is from the vicinity of San Diego, in which region *deleta* seems to occur more frequently than elsewhere, while the type of *deserta*—the specimen bearing the label—is from the Mojave Desert. In this latter the eyes are separated on the vertex by a distance subequal to half the length of the pronotum on the median line, and the third antennal joint is fully twice as long as wide, while in *deleta* the eyes are separated by a distance equal to two-thirds the length of the pronotum, and the third antennal joint is less slender, never quite twice as long as wide. There is virtually no difference in the form of the anterior tibiæ of the male in these two species, notwithstanding Horn's remark, nor do I believe the elytral costæ can be depended on as a mark of distinction.

There is a manifest inconsistency in the Horn tabulation of groups in this genus, in which it is stated that the species of Groups II–V have the "disk of the thorax irregular, median line more or less sulcate." This character completely fails in Group V, which includes the species we are now considering. A better character for the separation of this group would be the pubescence of the entire upper surface, which is always very obvious in even fairly well preserved specimens, and which does not exist elsewhere in our species.

Chrysobothris smaragdula, n. sp.—Moderately elongate, bright green above, dark green, with slight violaceous tint, below, surface moderately shining, glabrous. Antennæ with first three joints green, outer joints piceous, feebly metallic, gradually decreasing in width, third joint nearly as long as the next three. Front feebly convex, strongly, closely punctate; clypeus broadly triangularly emarginate, arcuate each side. Prothorax nearly twice as wide as long, sides straight and parallel

almost throughout, disk feebly, evenly convex, punctuation moderately coarse and close, with slight tendency to transverse strigosity. Elytra a little wider than the prothorax, sides parallel for three-fifths their length, then arcuately narrowed to apex, the tips separately rounded and serrulate; surface somewhat uneven, but without costæ or foveæ except the basal impressions ; punctuation similar to that of the prothorax. Prosternum coarsely, densely punctate, the flanks more sparsely so; abdomen sparsely punctate and polished; ventral segments without callosities, the last segment with submarginal serrate ridge, the lateral margin interrupted but not serrulate. Prosternum lobed in front, anterior femora toothed as usual. Length, 6 mm.

Oak Creek Canon, Arizona (Prof. Snow).

Described from a single female (?) specimen.

This species must be referred to Horn's Group VIII, and is most nearly related to *prasina;* this latter, however, has the prothorax narrowed anteriorly, the punctuation sparser, the last ventral without submarginal ridge.

Acmæodera robusta, var. *rubrosuffusa*, n. var.—In a series of specimens taken by Dr. Fenyes at Mojave, Cal., the basal portion of the disk of the elytra is broadly suffused with red. The prothorax is also brightly bronzed, and the abdomen violaceous-bronzed, instead of black as in the typical form. In this latter respect it approaches *tuta*, of which, indeed, it might be considered a variety with about equal propriety.

Acmæodera Hepburnii, var. *latiflava*, n. var.—This name is proposed for a form of *Hepburnii* in which the elytra are entirely yellow except the tip of the humeral umbone, a narrow sutural stripe, and one or two small spots at apical third. It looks so different from the typical form that it would naturally be separated in a cabinet arrangement, and has, indeed, been mistaken by collectors for a distinct species. It is known to me from the Yosemite region and from various points in So. California.

Acmæodera Bishopiana, n. sp.—Moderately stout, black, shining, not at all bronzed, prothorax with or without a very small yellow spot at sides near the base, elytra with numerous small irregular yellow spots, pubescence long, fine, erect, fuscous and cinereous, the latter colour predominating. Head densely punctate as usual, vertex finely carinate, clypeal emargination rather deep, nearly as in *labyrinthica*. Prothorax not wider than the elytra, twice as wide as long, widest a little before the

base, surface coarsely, deeply punctate, the punctures well separated toward the middle, the interstices polished. Elytra with coarsely punctate striæ ; intervals narrow, nearly flat on the disk. Beneath rather strongly, closely punctate ; apical ventral plate small and feeble, the free edge thin and evenly arcuato-truncate. Length, 6.5–8 mm.

Bishop, Big Pine and Independence, Inyo Co., California. Collected by Dr. Fenyes, June 7–12.

This species belongs to the "Emarginatæ," and is most nearly related to *labyrinthica*, which is, however, on the average a larger species, always distinctly bronzed, the form slightly flatter, the prothorax more closely and relatively a little more finely punctate, the elytra with more numerous and intricate markings. *Bishopiana* resembles quite closely a form which I hold to be a variety of *dolorosa*, taken by Dr. Fenyes in the same region ; this latter is somewhat flatter, more pointed behind, and with distinctly more broadly, less deeply emarginate clypeus.

Acmæodera faceta, n. sp.—Parallel, subcylindrical, dorsum a little depressed. Head and thorax black, elytra dark blue, with a small orange-red marginal spot near the posterior fourth ; beneath blue-black. Head not densely punctate, front moderately impressed at middle. Prothorax slightly narrower than the elytra, gradually narrowed in front, sides subparallel in basal third or half, punctuation sparse at middle, closer at sides, surface polished, basal impressions feeble. Elytra parallel for two-thirds their length or more, post-humeral sinuation feeble ; striæ moderate, intervals rather narrow, nearly flat on the disk, more convex laterally. Pubescence fine, sparse, whitish throughout. Front margin of prosternum with two distant obtuse but rather prominent lobe-like teeth. Ventral segments rather finely and densely punctate at sides, more sparsely at middle ; last ventral with feeble apical crest. Length, 5¾–7 mm.

Santa Rosa, Lower California (Beyer).

This species resembles *stigmata* and *bivulnera* quite closely. The prosternal characters are nearly as in *stigmata*, which species is, however, a little more gradually narrowed behind, lateral red spot more anterior in position, the prothorax green-bronzed rather than black, the abdomen more evenly punctate. In *bivulnera* the front of the prosternum is quite different in outline, having a rather strong sinuate lobe at middle.

Acmæodera larreæ, n. sp.—Strongly convex, subcylindrical, head, prothorax and under surface distinctly æneous, elytra yellow, with four or

five irregular pale brown fasciæ; pubescence sparse, fine, short, suberect and entirely whitish in colour. Antennæ very strongly serrate (♂) or moderately so (♀), the serration beginning with the fourth joint, which is as wide as the fifth; joints 4–10 all much broader and long. Head densely punctate, very feebly impressed. Prothorax one-half wider than long, sides not very strongly rounded, apex four-fifths as wide as the base, surface densely, almost cribrately punctate, median impression feeble, lateral basal foveæ moderately deep. Elytra barely as wide as the prothorax, sides feebly sinuate basally, gradually narrowed behind, striæ impressed, closely, moderately punctate, intervals narrow and more or less convex. Beneath with sparse white recumbent pubescence, prosternum truncate in front; abdomen rather sparsely, not coarsely, punctate, and polished; last ventral without apical plate. Length, 7½–9 mm.

The type is one of three examples taken by Dr. Fenyes at Mojave, Cal., on Larrea. In one specimen the brown bands are darker and wider, and the elytra might more properly be described as brown, with irregular yellow fasciæ. In this species the sexual differences in the antennæ are remarkable. Joints 4–10 are not only very broad in the male, but they are very densely minutely punctulate and clothed with an exceedingly short, erect blackish pile. In the female the surface of the joints is moderately punctulate and shining, and clothed as usual. By the broad fourth joint of the antennæ this species is related to *cribricollis*, *gemina* and *insignis*. By some mischance, *cribricollis* is, in my Synopsis of this genus, erroneously tabulated with those species having the fifth antennal joint abruptly wider than the fourth. The species is really very close to the one here described, but differs in having the elytral markings black instead of brown (perhaps not constant), the punctuation of the ventral segments coarser, especially apically, the last ventral with evident thick marginal crest. Males of *cribricollis* are as yet unknown, so it is not possible to say if a similar sexual disparity in the form of the antennæ exists.

Trirhabda labrata, n. sp.—Form and size of *flavolimbata*. Elytra brilliant green, with narrow pale margin, pubescence unusually sparse and short, the surface quite strongly shining, punctuation dense and rather coarse. Prothorax about twice as wide as long, more or less strongly transversely impressed, and with the usual three spots, these being large, sometimes confluent, metallic-green; surface highly polished and sparsely

punctured, the pubescence nearly wanting. Head testaceous in front, labrum blackish ; occiput entirely green, sparsely, finely punctured and shining. Antennæ in great part piceous ; under side of body and legs testaceous, varied with dark green or piceous. In the male the last ventral is rather strongly and broadly emarginate at apex ; in the female there is a small subcircular emargination, the sides of which nearly meet behind. The inner division of the claws is as usual a little shorter and more divergent in the female. Length, 6¼–7½ mm.

Monterey, California (Fenyes).

The brilliant green colour, sparse pubescence, shining surface and dark labrum are the distinguishing characteristics of this species. The punctuation of the elytra is also evidently coarser than in *flavolimbata*, and much coarser than in *luteocincta*, in both of which species the labrum is pale, or at most slightly dusky, the head more densely punctate and dull, the occipital plaga less extended, not as a rule involving the upper inner margin of the eye.

Trirhabda eriodictyonis, n. sp.—Oblong, rather robust, not broader behind, testaceous throughout, antennæ dusky except at base, head with a very small occipital plaga, which becomes linear in the female, and is rarely entirely wanting. Prothorax with the three spots small, black ; elytra with greenish elongate humeral spot, which may extend the entire length of the elytra, or may become almost obsolete. Head densely, rather coarsely punctate, feebly shining; prothorax sparsely, feebly punctate or nearly smooth, polished ; elytra densely, finely punctate.

Male with broad but distinct apical ventral emargination ; female with much narrower but relatively deeper emargination. Length, 7½–9 mm.

This species occurs rather abundantly on a species of Eriodictyon ("Yerba Santa ") at Pasadena, San Bernardino and elsewhere in Southern California.

It has been distributed quite generally as *caduca*, on the basis of an erroneons identification made years ago for the writer. The latter species is much smaller, very sparsely pubescent, more shining, less densely punctate, the dark markings without metallic lustre, the occipital spot much larger. It is known only from Owens Valley. *Nigrohumeralis*, Schf., is still closer to the present species, but in it the punctuation is somewhat coarser, and, like *caduca*, it is smaller and the dark markings are not at all metallic.

ON SOME HAWAIIAN HEMIPTERA-HETEROPTERA.

BY G. W. KIRKALDY. HONOLULU, HAWAIIAN ISLANDS.

Fam. MYODOCHIDÆ.

In the "Fauna Hawaiiensis—Hemiptera," in dealing with White's species of "*Cymus*," I had specimens before me of *C. criniger* only; since then I have seen White's *C. calvus*, and another species allied thereto, but with substylate eyes; these three form three genera, distinguished as follows:

1. Eyes substylate, prominent, extending laterally well beyond the pronotum, which is distinctly longer than wide; tegmina scarcely punctured .... *Nesomartis*, gen. nov.

1a. Eyes sessile, not prominent, not extending laterally so far as the transverse pronotum; tegmina strongly punctured .... 2.

2. Ocelli as far from one another as from an eye. Pronotum with a distinct transverse impression basal of the middle .... *Nesocymus*, gen. nov.

2a. Ocelli much nearer to the eyes than to one another. Pronotum not transversely impressed .... *Sephora*, Kirkaldy.

The character of the nonpunctuation of the tegmina in *Nesomartis* would remove it from the Cyminæ in the usual acceptation of the subfamily, but it is obviously closely related to *Nesocymus* and *Sephora*. I cannot find any character to separate satisfactorily the Cyminæ from the Astacopinæ (Lygæinæ of some authors), and the amalgamated subfamily should be known as Cyminæ. Stal (Hem. Afr., ii, 120) relies on the tegmina being wider than the abdomen, and the exterior margin of the corium dilated, while his "Lygæida" have the tegmina not, or only partly, dilated and wider than the abdomen, but the latter is not the case in many forms. I think that *Nysius* is more closely allied to *Cymus* than it is to *Stalagmostethus* and its allies.

Sephora, Kirkaldy.

Sephora, Kirkaldy, 1902, Faun. Haw., iii, 161.

The rostrum barely reaches to the middle coxæ, first segment *not* extending quite so far as the base of the head. Collar feebly marked, pronotum scarcely constricted there, and not constricted again towards the base. Ocelli much nearer to the eye margins than to one another.

1. *criniger* (White).

Cymus criniger, F. B. White, 1881, A. M. N. H. (5), vii, 57.

Sephora criniger, Kirkaldy, 1902, Faun. Haw., iii, 161, Pl. v, f. 45.

The specimens before me agree fairly well with White's description, except as follows: the general colour of the head is paler; the membrane is almost always faintly marked longitudinally with a fuscous stripe, and the rostrum just reaches to the middle coxæ, instead of to the middle of the mesosternum, while the first segment does not reach as far as the base of the head, instead of to the middle of the prosternum. I feel sure White's description is incorrect in this.

Hab.—Lanai and Molokai, as detailed previously; White records it from Maui at 5,000 feet, under stones, but Dr. Perkins informs me that the specimens collected by him were beaten from the branches of trees, where they probably live under moss or lichens.

Nesocymus, gen. nov.

Allied to the last, but the distances between the ocelli, and from an ocellus to the nearest eye margin, are subequal. The rostrum reaches to the middle of the mesosternum, the first segment reaching to the base of the head. Vertex more convex, and eyes larger. Pronotal collar more marked, the pronotum exteriorly rounded after this, and divided into two parts by a median transverse very narrow impressed line.

1. *calvus* (White).

Cymus calvus, F. B. White, 1881, A. M. N. H. (5), vii, 56.

Sephora calvus, Kirkaldy, 1902, Faun. Haw., iii, 162.

Hab.—Oahu (as previously noted), at roots of herbage in the mountains, from 1,500–2,000 ft. Dr. Perkins has lately collected a series of forms agreeing with White's description, except as follows: there is always a dark, broad, fuscous longitudinal stripe on the membrane (not noted by White), and his rostral proportions do not agree.

Nesomartis, gen. nov.*

Differs from the two preceding genera by the very transverse vertex and substylated eyes, which extend laterally much further than the pronotum; by the ocelli as close to one another as to the eye margins, and being close to the anterior margin of the pronotum (they are somewhat distant in the other genera), by the elongate, collarless pronotum, whose lateral margins are straight and scarcely divergent. Tegmina scarcely punctured. Rostrum reaching middle coxæ, mesosternum rather deeply sulcate posteriorly.

N. psammophila, sp. nov.

Pale greenish, drying to testaceous, with sparse whitish-pubescence, a lævigate elongate spot on each side of the pronotum anteriorly.

**Nesos*, island, *martis*, maiden.

Scutellum with a percurrent fuscous longitudinal line extending to apex of clavus. Tegmina hyaline, each with a median longitudinal fuscous streak, which converge on the membrane when the tegmina overlap in repose. Fourth segment and apex of second segment of antennæ fuscous. Metanotum and tergites dark fuscous, margined laterally with testaceous. First segment of antennæ reaching just beyond head, second segment about 4½ times as long as the first, and about as long as the incrassate fourth, which is a little longer than the third. Length, 4¾ mm.

Hab: Oahu, on the coast on the ground amongst *Sida* and other plants (R. C. L. P.); Hawaii, Kona coast in similar situations (R. C. L. P.). The Hawaiian specimens have the second and fourth segments of the antennæ each five times as long as the first, but do not otherwise differ appreciably from the typical Oahuan.

1. *Orthæa nigriceps* (Dallas).

(= *Orthœa nigriceps*, Kirkaldy, olim.)

F. B. White, on Blackburn's authority, states that this species does not occur below about one thousand feet above sea level, but that was probably a mistake then, and certainly is so now, as it comes at night to light in houses from sea level upwards. It occurs also in Tahiti and the Philippine Isles. Mayr recorded it from New Zealand, but White, on the strength of an allied form (*Douglasi*) from the latter country, considered Mayr's record erroneous. Distant has now, however, considered *Rhyparochromus inornatus*, Walker, from New Zealand, to be a variety of *O. nigriceps*, and if Distant's identification be correct, it is probable that Mayr's New Zealand forms were actually *O. nigriceps*.

2. *O. periplanios*, sp. nov.

This pretty little species is much smaller and less robust than the preceding; it does not fit into either of Stal's primary groups of "*Pamera*," being removed from "*a*" by the anterior lobe of the pronotum being very distinctly transverse, from "*aa*" by the said lobe being very slighly narrower than the head. It is probably allied to *vincta*, Say, but has unicolorous, dark ochraceous fore femora.

Black, with silvery-gray pubescence; first three segments of antennæ, the rostrum and legs ochraceous, fore femora darker ochraceous, last segment of rostrum dark. Tegmina yellowish-testaceous, strongly punctured with dark brown, costal margin paler, immaculate, except the apical margin; apical margin of corium broadly but unevenly blackish-brown, sometimes extending a little way along the inner margin, a white spot at the inner posterior angle. Membrane pale, with several longitudinal pale smoky streaks. Head distinctly longer and slightly wider than

the anterior lobe of the pronotum; first segment of antennæ reaching beyond the head, fourth segment the longest, fusiform; rostrum reaching to the fore coxæ. The collar well marked, not as wide as the anterior lobe; the latter nearly twice as wide as its length, laterally rounded, basally very slightly wider than in front; posterior lobe finely but sparsely punctured, raised and rounded behind, scarcely shorter medially than the anterior lobe, very distinctly wider than the head, its lateral margins diverging at first obtuse-angularly, then turning sharply parallel with the long axis of the body; posterior margin very lightly emarginate. Scutellum medially carinate on the posterior two-thirds. Fore femora incrassate and spinose, tibiæ not toothed, but apically a little widened and subbifid.

Length, ♂, 3⅛ mm.; ♀, 4 mm.

Hab.: Hawaiian Archipelago (introduced), now spread over Kauai, Kekaha (F. W. T.); Oahu, from sea level to Mt. Tantalus, 1,500 feet (R. C. L. P., W. M. G., G. W. K.); Maui, Olowalu (O. H. S.); comes frequently to light.

In examples not fully matured the collar and posterior lobe of pronotum may be dark ferruginous, instead of black.

The types (♂ ♀) are in my collection.*

Fam. REDUVIIDÆ.

Triatoma rubrofasciatus, DeGeer.

Probably originally a native of Brazil, now widely distributed. It is found in these Islands near cottages of the poorer sort.

Zelus peregrinus, Kirkaldy.

Mr. O. Heidemann has (*in litt.*) identified this as identical with *Z. Renardii*, Kolenati (1856, Bull. Soc. Nat. Moscou, XXIX, 460, Pl. III, fig. 2), from California, but I am not disposed to admit it on present evidence. Kolenati's figure is useless, and he states that the apex of the femora and base of the tibiæ are intensely sanguineous, which I do not consider them to be, at least noticeably. The anterior lobe of the pronotum is also not very distinctly quadrituberculate, nor is the abdomen entirely lurid. *Z. Renardii* has not to my knowledge been redescribed since 1856.

Milu, gen. nov.†

Differs from *Reduviolus*, W. Kirby, by the incrassate first segment of the antennæ and the prominent blunt spine arising well in front of the antennal insertion from the side of the head, which I formerly overlooked, but which has been pointed out to me by Dr. Perkins.

*Since writing this I have seen specimens from Australia and Viti.

†*Milu* is the Hawaiian ruler of the dead.

1. *kerasphoron*, nom. nov.

= *Reduviolus rubritinctus*, Kirkaldy, nec Blackburn. The latter has the incrassate antennæ, but as the head spines are not mentioned it cannot yet be included in *Milu*. *M. kerasphoron* is very much like *R. sharpianus*, Kirkaldy, in pattern.

SUMMARY :

Sephora criniger (White.)
Nesocymus (n.g.) *calvus* (White).
Nesomartis (n.g.) *psammophila*, n. sp.
Orthæa nigriceps (Dallas).
O. periplanios, sp. nov.
Triatoma rubrofasciatus (DeGeer).
Zelus peregrinus (Kirkaldy).
Milu (n.g.) *kerasphoron*, sp. n.

NOTES ON CENTRAL AMERICAN HEMIPTEROUS FAUNA.

BY G. W. KIRKALDY, HONOLULU, HAWAIIAN ISLANDS.

While preparing his account of the Homoptera of Central America (Biologia Centrali Americana, Rh. Hom. II), Mr. Distant must have neglected to refer to the third part of Stal's "Analecta hemipterologica" (1869, Berlin Ent. Zeit., XIII, 225–42), as he has omitted mention of four species therein described ; these are as follows :

Aphrodisias (=|| *Compsoptera*) *cacica*, Stal ; *Acmonia anceps*, Stal ; *Cyrpoptus nubeculosus*, Stal, and *C. ferruginosus*, Stal, all from Mexico.

In the Annals and Mag. Nat. Hist. (7), XVIII, 193 (1906), Mr. Distant twice quotes his genus "*Amilavaca*" (as a syn. of *Echetra*); this was, however, originally written *Amalivaca*.

In the same volume of the "Biologia" Dr. Fowler has redescribed *Scolops*, Germ., under the name of *Ornithissus*, incorrectly placing it in the Issidæ. *S. Cockerelli* seems to be a good species (p. 122).

I have not seen specimens, but the descriptions and figures, as well as comparison with *Mistharnophantia*, Kirkaldy, lead me to believe that *Hypancylus*, Fowler (p. 114), is a Poekillopterine, not an Issine.

Of the two Fulgoroids considered uncertain by Dr. Fowler, *Rhotala* is an Achiline, while *Syntames* is a Derbid, his *delicatus*, var. *chiriquensis* (p. 139), being a good species.

In the Cicadidæ, Mr. Distant's new name of *Germari* (p. 140) for *Proarna* ||*grisea* (Germar) is unnecessary, as on his own showing there are other names available. The insect should probably be known as

Proarna invaria (Walker). Mr. Distant has copied the mistake into his Catalogue of Cicadidæ.

The second volume of the Homopterous part ends very abruptly at p. 316, in the middle of a sentence; this was published in August, 1903!

In the Heteroptera (Vol. II.) Mr. Champion has confused under one generic name, *Lutevopsis*, two distinct genera.

Lutevopsis, type *longimanus*, Champ., has a few large spines on the fore femora, and the hind femora extend much farther than the abdomen posteriorly, and are not pilose; the tegmina are not picturate.

Panamia, gen. nov., type *ornata* (Champ.), is somewhat allied to *Ploiariodes*, White, but has no scutellar spines; it has no large spines on the fore femora, the hind femora do not extend farther posteriorly than the abdomen, and are lightly pilose; the tegmina are picturate.

The head and pronotum are also very different in the two genera.

Since the publication of Bulletin IV of the Div. Ent. H. S. P. A., I have received Melichar's fine Monograph of the Issinæ, and have been able to confirm the two Issines noted by me from Arizona.

(1) *Bruchomorpha mormo*, Kirk., is allied to *B. pallidipes*, Stal, but is concolorous except part of the legs (duly described).

(2) *Picumna ovatipennis* (Walker) may be confirmed.

1. *Plinthærus mexicanus*, Spinola, 1850, Mem. Soc. Ital. Modena, XXV (sep. p. 115). This genus is treated by Stal, in discussing the Ethiopian forms, as a homonym of *Ptyelus*, Lep. and Serv. I cannot identify *P. mexicanus* with any of the Cercopidæ enumerated by Fowler.

2. The use of *Tetigonia* in Hemiptera has been objected to by Jacobi (in his current works) as being preoccupied by *Tettigonia* in Orthoptera. I cannot agree, especially as Geoffroy does not refer to Linneus's genus; even then, however, Jacobi's new name, *Tettigoniella*, would fall before *Cicadella*, Latreille, 1817 (Cuv. Règne An., III, '06), of which the *Tettigonia* of Olivier and Germar is the typical subgenns, as stated by Latreille himself.

3. *Microcentrus*, Stal, 1869, = *Phaulocentrus*, Fowler, 1896. Stal gives *caryæ* (Fitch) as the type of his Membracid genus. Fowler rarely cites types for his genera, but as *caryæ* is the first mentioned, it may be taken as the type.

4. In the B. C. A. Hom., II, Fowler refers to the *Achilius bicinctus*, Spinola, redescribes and figures what he supposes to refer to it.

I do not believe that Spinola's species really refers to *Colgorma* (=||*Rudia*); Stal was uncertain. Fowler's *bicinctus* can scarcely be the

same as Spinola's, as the venation is too discordant. Spinola's figures are mostly excellent, and there is no reason to force his South American form to fit an at least superficially different Central American. I therefore propose *Colgorma Fowleriana*, n. n., for *Rudia bicincta*, Fowler, not = *Achilius bicinctus*, Fowler.

A PRELIMINARY LIST OF THE CONOPIDÆ OF NEBRASKA.

BY PAUL R. JONES, UNIVERSITY OF NEBRASKA, LINCOLN, NEBRASKA.

1. CONOPS, Linné.

1. *Conops brachyrhynchus*, Macquart.—Specimens from West Point, Lincoln and Meadow, Nebraska, which agree with the description, except that the cheeks and facial grooves are slightly darkened in some of the specimens. There is also a variation in size, the specimens being from 8 to 12 mm. in length.

2. *Conops fronto*, Williston.—Numerous specimens from Glen, Sioux County, Lincoln, Nebraska City, Haigler, McCook and Pine Ridge, Nebraska. Common in northwestern Nebraska in the fall.

3. *Conops xanthopareus*, Williston.—Numerous specimens from Lincoln, West Point and Glen, Sioux County, Nebraska. Common in the eastern and in the north-western part of the State in August and September. This is the first record of its being taken this far west.

2. PHYSOCEPHALA, Schiner.

1. *Physocephala affinis*, Williston.—Specimens from West Point and Glen, Sioux County, Nebraska, which show considerable variation in the frontal stripes, markings of cheeks and wings, and length of the ultimate segment of the fourth vein. The cheeks in two specimens are entirely brown

2. *Physocephala marginata*, Say.—Two specimens from Lincoln, one from Weeping Water, and one from West Point, Nebraska, which answer to the description, except that the specimens from Lincoln and Weeping Water are about 15 mm. in length. The specimen from West Point is smaller, and slightly lighter in colour. Formerly recorded from Pennsylvania and New Hampshire.

3. ZODION, Latreille.

1. *Zodion fulvifrons*, Say.—Numerous specimens from Lincoln, West Point, Halsey, Cedar Bluffs and Glen, Sioux County, Nebraska, which show great variation in size and coloration. Very common over the entire State.

2. *Zodion obliquefasciatum*, Macquart.—Six specimens from Dundy Co. and Lincoln, Nebraska.

3. *Zodion parvum*, Adams.—Seven males and four females from Glen, Sioux County, Nebraska, August, 1906, on *Helianthus* and *Solidago* (P. R. Jones). As this species has hitherto been known from but a single male from Arizona, I give a description of the female:

♀.—Length, 3.5 mm. Black species. Face and cheeks yellow, the latter with a silvery reflection, front fulvous, with a narrow black line on each side, vertex black. Antennæ red, first joint and upper part of third blackish, arista black. Proboscis black, 2.4 mm. in length, labella in length equal to the height of the eye. Palpi short. Mesonotum and scutellum black, subfulgent, pollen gray, more evident on the sides. Legs black, except the base of tibiæ, metatarsi and pulvilli, which are yellow. Coxæ and outer part of tibiæ with a silvery sheen. Wings nearly hyaline, very slightly tinged with brown; first posterior cell closed and petiolate, petiole nearly as long as the posterior cross-vein. Pile everywhere black.

4. *Zodion scapulare*, Adams.—Ten males and ten females, and two pairs taken in copula; Lincoln, Nebraska, July and September, and Glen, Sioux County, Nebraska, August (P. R. Jones). Formerly known from a single male from Arizona. The female agrees with the description of the male, except that the abdomen is entirely black, subfulgent with gray pollen, which is more prominent on the sides. The whole series varies from 5 to 6.5 mm. in length. The proboscis is about 4 mm. in length, with the labella nearly as long as the height of the eye. The petiole of the first posterior cell is only slightly longer than the small cross-vein.

5. *Zodion pygmaeum*, Williston.—Numerous specimens from Lincoln, West Point and Glen, Sioux County, Nebraska, on *Solidago* (P. R. Jones). Rather common in the State from June to August. Formerly recorded from California, Colorado and Mexico.

4. Stylogaster, Macquart.

1. *Stylogaster neglecta*, Williston.—One female from West Point, Nebraska, June 22, 1905 (H. S. Smith), which agrees in every way with the description.

5. Dalmannia, Robineau-Desvoidy.

1. *Dalmannia nigriceps*, Loew.—Two males from Lincoln, Nebraska, and two females from Sioux County, Nebraska, which agree with the description, except that the posterior femora of the males are black, with the base and apex yellow, and the anterior femora in the females are black, except at the apex, which is yellow.

6. ONCOMYIA, Robineau-Desvoidy.

1. *Oncomyia abbreviata*, Loew.—One male from Sioux County, Nebraska, May, on *Oxytropis*. The legs are black, except the base and apex of hind femora, base of all the tibiæ and metatarsi, which are yellow.

2. *Oncomyia Baroni*, Williston.—Specimens from West Point, Lincoln and Glen, Sioux County, Nebraska, which show considerable variation in the coloration of the antennæ and legs.

3. *Oncomyia loraria*, Loew.—Two males from Lincoln, Nebraska, which on account of their small size I believe should be placed here. They agree with Loew's description, except that the lines of the thorax are indistinct, and the second joint of the proboscis is not longer than the first, but is about equal to it. Length, 3.5 mm.

4. *Oncomyia propinqua*, Adams.—A male on *Cleome* and a female on *Petalostemon*, both from Glen, Sioux County, Nebraska, August, 1906 (H. S. Smith). This species is evidently very close to *O. Baroni*, if not a variety of it. It can be separated, however, by its more slender form, longer and more delicate proboscis, and more black colour in general. The legs are entirely black, except the extreme base of the tibiæ, which is yellow.

1. MYOPA, Fabricus.

1. *Myopa clausa*, Loew.—Numerous specimens from Lincoln and Sioux County, Nebraska, April and May. The specimens vary from 5.5 to 9.5 mm. in length, and show some colour variation also.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 21.

THE SCOLYTIDÆ OR ENGRAVER-BEETLES.

BY J. W. SWAINE, ITHACA, N. Y.

(Continued from page 195.)

THE AMBROSIA- OR TIMBER-BEETLES.—The Ambrosia- or Timber-beetles breed entirely within the wood, the eggs of some species being laid well within the heart-wood. There may be several secondary egg-tunnels cut by two or more females, branching from a primary tunnel, which leads from the common entrance hole. Rarely the tunnels of closely-allied species branch from a common entrance hole.

The number of males in this group is small, in some species there being seldom more than one or two males in a brood of fifteen or twenty. In many species the males are apterous, and the females are fertilized before leaving the tunnels in the spring. Among the Bark-beetles the males are apparently quite as numerous as the females.

In two genera, Platypus and Xyleborus, the eggs are deposited free in the tunnels. The larvæ of Platypus live free in the tunnels until nearly ready to pupate, when pupal cells (cradles) are cut from the sides of the tunnels deep within the wood.

The larvæ of Xyleborus live and pupate within the parent tunnels without cutting pupal cradles. In Corthylus, Trypodendron, Pterocyclon and Gnathotrichus the eggs are laid in shallow niches cut by the female along the sides of the tunnel, and usually well within the wood; the larvæ extend these niches away from the tunnel, forming larval cradles, in which they remain until mature. The length of the completed cradles is slightly greater than that of the adult beetle.

The adults of the Ambrosia-beetles bestow great care upon the young larvæ, supplying them with the food-fungus, referred to below, and removing the excrement from the cradles. In some species even older larvæ assist in caring for the eggs and younger larvæ. The habits of many species are almost as remarkable in this respect as are those of the social Hymenoptera.

The chief and probably the entire food of these beetles is a fungus known as Ambrosia, which they propagate within their tunnels. From this habit comes the name "Ambrosia-beetles." The tunnels are kept entirely free from chips and refuse, and the walls are covered by the fungus growth. So far as known, except in the cases of a few closely-allied forms, each species of beetle uses a characteristic species of fungus. The mycelium of the fungus pervades the tissue about the tunnels for one or two millimetres, colouring the wood dark brown or black, so that the tunnels have the appearance "of having been bored with a red-hot wire." By this means the tunnels of Ambrosia-beetles are easily distinguished from those of all other wood borers. When new tunnels are cut, the fungus is carried there by the beetles, and started upon the tunnel walls, in some cases upon specially-prepared beds of chips and excrement.

When working in large trees some species enlarge the same set of tunnels through several generations; but usually each generation excavates a new abode.

An excellent discussion of the habits of the Ambrosia-beetles, by Mr. H. G. Hubbard, is published in Bulletin No. 7 of the U. S. Division of Entomology.

THE TWIG-BEETLES.—The Twig-beetles include a few species belonging mainly to the genera Hypothenemus, Pityophthorus and Micracis. They bore into the bark and wood of terminal twigs of trees and shrubs both for food and for breeding purposes. They feed upon the

bark and wood, and in some cases apparently upon buds and young shoots. Some engrave the wood surface as do the Bark-beetles; some have in addition deep chambers within the wood; and with others the primary tunnel is cut through the pith itself. With some species the eggs are laid free in the primary tunnels, and the larvæ either feed upon the tunnel walls or cut longer or shorter mines through the wood. Several species of this group have a very close relation to a fungus always found in their tunnels.

A summary of the burrowing habits of these first three groups brings out some interesting relations. Among the Bark-beetles the eggs are usually laid in niches along the sides of the primary tunnels, and the larval mines are usually well-developed. A few species cut their tunnels and mines entirely in the bark; many cut them between the bark and the wood, the pupal-chambers being merely an enlargement of the ends of the larval-mines; others form the pupal-chamber by driving the ends of the larval-mines a half inch or less vertically into the wood, some even cutting the distal half of the larval-mines just below the wood surface; and lastly, a very few small species cut almost the entire system of tunnels and mines slightly below and parallel to the surface of the wood. The Twig-beetles cut both tunnels and mines, when the latter are present, through the wood and pith of twigs. Among the Ambrosia-beetles the tunnels are in all species entirely within the wood, but the depth to which they enter varies considerably with the species. In the genera Corthylus, Pterocyclon, Trypodendron and Gnathotricus the eggs are laid in niches along the sides of the tunnels, and the larvæ cut very short mines, known as cradles. The species of Platypus lay the eggs free in the tunnels, but the larvæ when nearly ready to pupate cut short cradles in which they pupate and remain until mature. In the genus Xyleborus the eggs are laid free within the tunnels, but the larvæ cut no cradles, pupating in the primary tunnels. There is thus a fairly well-marked gradation both as to the depth of the tunnels and mines below the surface and as to the degree of development of the larval mines.

The fourth group contains those species not included among the Bark-beetles, Ambrosia-beetles and Twig-beetles. The American species are few in number. *Coccotrypes dactyliperda*, an imported form, burrows in date seeds; *Cryphalus jalappæ* is found in jalap root; *Hypothenemus eruditus* burrows in nuts, book-bindings, and other dry substances, as well as in dead twigs of grape and orange, and the young leaves of sugar-cane; *Pityophthorus coniperda* occurs in pine cones; *Xyleborus sacchari* attacks

the sugar-cane ; *Hylastinus obscurus* bores in the roots of clover ; and *Cactopinus Hubbardi* in the pith of the giant cactus.

Enemies of the Scolytidæ.—The Scolytids have many natural enemies. They are preyed upon by many predaceous and parasitic insects, by birds, and are frequently attacked by fungous diseases.

Adults and larvæ belonging to the families Cleridæ, Staphylinidæ, Colydiidæ, Histeridæ and others enter the burrows and feed upon the eggs, larvæ, pupæ and adults of the Scolytids. The predaceous larvæ often burrow through the larval-mines after the Scolytid larvæ, which they finally overtake and devour. Various dipterous larvæ feed upon the eggs and younger stages. Many hymenopterous parasites, Braconids, Chalcids and Proctotrypids, prey upon the larvæ and pupæ, and have even been bred by Dr. Hopkins from the adults, the parasite emerging through a hole cut in the elytra. Larvæ of large wood-boring beetles, such as Monohammus, destroy the Scolytid tunnels and prove serious enemies to the beetles. Woodpeckers destroy large numbers of the Bark-beetles, but apparently do little to check their ravages.

The tunnels, especially of the Timber-beetles, are frequently overrun with various species of mites. The eggs of these mites hatch before the young beetles are ready for their flight, and in this way young and adult mites are carried by the beetles to the new tunnels. At certain times the declivity of the elytra of various species of Ips (Tomicus) will be found covered with minute mites, and *Pterocyclon mali* and *P. fasciatum* are frequently almost completely covered with them upon emerging from their tunnels in the spring.

Fungous diseases are sometimes very injurious. All stages of the insects are frequently found, more particularly in wet weather, filled and covered with the white mycelium of the fungus. In a felled pine log I noticed that hundreds of adult *Ips pini* had died from this cause in less than two weeks.

Friends of the Scolytidæ.—As these beetles feed mainly upon dying and dead branches and trunks of trees, any cause which tends to weaken or destroy the trees aids the Scolytids in supplying the proper food-plant. Heavy storms, forest fires, other insects, and the destructive work of man, are perhaps the chief of these.

Economic Importance.—Owing to the destructive habits of many of its members, the family Scolytidæ is of considerable economic importance. The injury done by these beetles may take two forms: living trees may be weakened and killed, and standing and felled timber and sawn lumber may be rendered useless for many purposes by the tunnels of the beetles.

But few Scolytids attack living, healthy trees, although there are a few species which apparently choose only trees in this condition. The

majority of species attack only dying or dead trees.* Stumps, diseased or dead branches, brush piles and recently-felled logs are their favourite breeding places. Most species will not, as a rule, molest living trees at all if rapidly-dying and recently-felled food-plants are available, but if trees in this condition are not to be had in sufficient quantity, many of these species will attack perfectly healthy trees and prove very destructive. Between 1882 and 1889 *Polygraphus rufipennis*, which does not ordinarily feed upon living trees, destroyed, according to Dr. Hopkins, approximately 10% of the 500,000 acres of growing spruce in West Virginia.

The injury done by the species which attack healthy and diseased trees is, in certain regions and at recurring intervals, very considerable. The work of *Dendroctonus frontalis* in the spruce and pine of West Virginia and the adjoining States, of *D. piceaperda* in the spruce of the Northeast, and of *D. ponderosa* in the spruce and pine of the Black Hills of South Dakota, may be cited in illustration. *D. frontalis* and *D. ponderosa* attack the living, healthy spruce and pine, and in spite of the resin are able successfully to rear their young within the bark. The tunnels and mines thus formed interfere seriously with the flow of sap, and either kill the tree outright or induce an unhealthy condition favourable to the attacks of other borers and fungous diseases. It seems very probable that many destructive forest fires have been fed by trees dying or dead from the attacks of Scolytids. In 1903 Dr. Hopkins estimated that the destruction, in the previous three or four years, of 10% of the white pine and 75% of all other species of pine, throughout an area of over 10,000 square miles in the States of Virginia and West Virginia, was to be attributed to the ravages of *D. frontalis*. In 1904 the same writer pointed out that *D. ponderosa* had been the primary cause of the destruction of 1,000,000,000 feet of Bull Pine in the Black Hills of South Dakota and the Rocky Mountain region.

The Timber-beetles, by driving their tunnels through the wood in many directions, often render timber unfit for use.

Hylastinus obscurus breeds in the roots of clover in many parts of the Northeastern States and in Canada, and in some localities proves a serious pest.

Corthylus punctatissimus occasionally does considerable damage in young sugar-maple plantations.

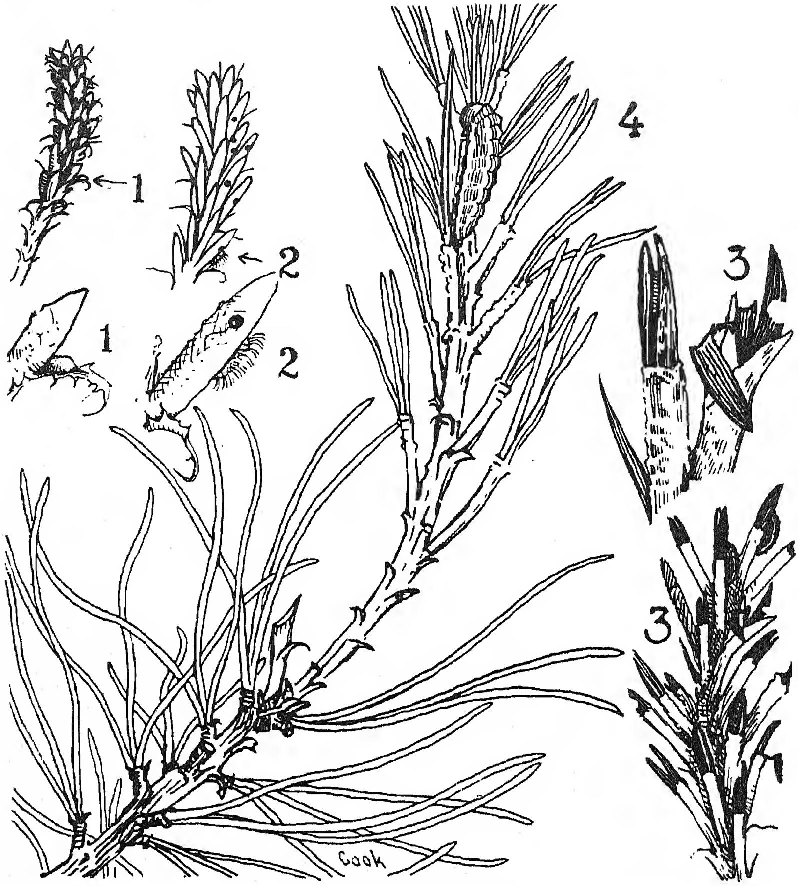
Scolytus rugulosus, the fruit bark-beetle, attacks unhealthy fruit trees of all sorts, and occasionally bores in apparently perfectly healthy trees.

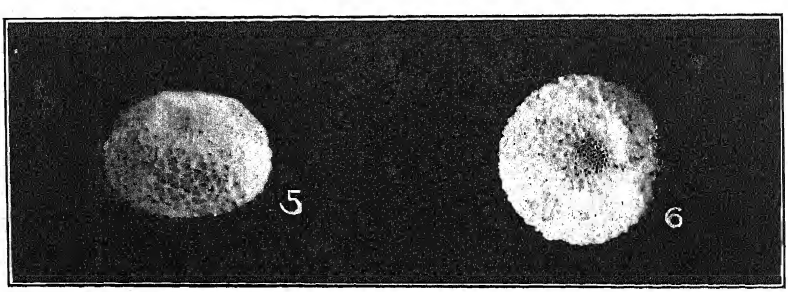
Phlœotribus liminaris frequently attacks diseased peach and cherry.

Xyleborus dispar sometimes occurs in diseased apple trees.

*(A few breed in dead wood only.)

Mailed July 8th, 1907.





INCISALIA NIPHON.—LARVAE AND EGGS.

The Canadian Entomologist.

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STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

IV.—INCISALIA NIPHON.

(Continued from page 235.)

The life-history of *niphon* has been known in part for many years. The egg, newborn larva, mature larva and chrysalis have been studied and described with minute exactness, but the literature contains no mention of the transitional larval stages, and I have been unable to find any record of the species having been successfully carried through from egg to imago. I first bred this insect in 1903 from caterpillars taken at Albany, and during that and the two succeeding years worked out the entire life-history; but before the text was ready for publication all my notes, drawings and preserved material (including exuviæ, egg-shells, etc.) were destroyed by fire. In 1906 other work prevented my devoting to the species as much time and attention as was desirable, and the material secured for study consisted of a single egg and a larva in the penultimate stage. This season eggs were obtained from a female taken at Lakewood, N. J., and confined over pitch pine; some of the larvæ from these have already pupated, and once again the record is complete.

The above statements are made because what follows, while drawn mostly from notes and sketches, is, in part, based upon my memory of observations made some years ago.

Time of Flight.—Species single-brooded, the butterflies appearing about a week later than *irus* and *Henrici* (at Albany not before the 10th of May). They become abundant in a few days, and practically disappear before the end of the first week in June, though I have the record of a female which had not yet disposed of her eggs captured at Albany as late as the 24th of June. Two males were taken at Lakewood as early as the 4th of May (1907), and on the 18th the females were observed ovipositing. All other exact data on this point were lost.

Oviposition.—Eggs are laid from the middle of May to early June and perhaps (exceptionally) later. They are placed singly on the new growth of the food-plant, *Pinus rigida* (pitch pine), either on the upper surface of the scale leaves or tucked deeply among the still sheathed bundles of needle leaves. All the eggs found in nature were in the former position near the base of the new shoot, where the first elongation of the stem occurs, never toward the apex (Plate 6, fig. 1). The female selects young trees from two to six feet in height, and apparently never oviposits on those of larger growth. She lays from 25 to 40 eggs. I have found several eggs by searching the young shoots with a pocket lens, and twice have been fortunate enough to witness a female in the act of ovipositing. One of these placed an egg only fourteen inches above the ground on a pine just beginning its third year of growth.

I have never found an egg or a caterpillar on *P. strobus* (which has been considered the favourite food-plant), nor have I observed the butterfly in the neighbourhood of that tree except where *rigida* was also abundant.

The Egg.—Considerably larger than the egg of any of the congeneric species ; echinoid, top flattened, at micropyle depressed, pale green. The primary ornamentation of the shell consists (as in *irus*, *Henrici* and *augustus*) of a raised reticulation, the meshes of which form fairly regular equilateral triangles, and at each angle, except on the top and bottom, a low rounded boss or knob. There is also a secondary ornamentation difficult to describe, but giving the egg a frosted appearance and a superficial similarity to the egg of *Henrici*. This ornamentation is in the two eggs of much the same character, but in *niphon* is not so pronounced, does not render the shell so opaque, and presents other differences easier illustrated than described. Figures 5 and 6 give the side and top views of the egg of *niphon*. The illustrations are from photomicrographs of an empty shell, from which the larva very conveniently made its exit near the bottom on the side, which appears to be somewhat flattened in fig. 6. The magnification is the same as was used in representing the shells of *irus* and *Henrici* (CANADIAN ENTOMOLOGIST, Vol. XXXIX, Plate 4, June, 1907).

Period of Incubation.—Of thirty-three eggs laid by a confined female on May 19th, 1907, between 9.30 a.m. and 1.30 p.m., the first hatched at 10.20 p.m on May 28th, the last at 2 p.m on June 1st. The period,

therefore, varies from 9 days 12 hours to 13 days 2 hours, though the average (10 days 8 hours) is represented by the minimum more nearly than by the maximum.

Larval Life.—The newly-hatched larva does not make a meal of the deserted egg-shell, though in eating its way out it may devour the entire top. More frequently, however, it is satisfied to make a hole only large enough to crawl through, usually in the top, thus destroying a part of the micropyle.

The little caterpillars are stronger and more vigorous than those of the related species, and crawl about at a speed that argues well for their future good health. Making their way among the tough hairs (?) which bind together the sheaths containing the needle clusters, they fasten upon the side of a sheath and bore through it a minute hole, enabling them to reach the tender tissue of the needles upon which they feed (fig. 2). Into this hole the head is thrust, and the larva excavates as much of the interior as it can reach without getting its body inside.* It makes a new puncture whenever necessary, and by these the presence of the caterpillar may often be detected. The excrement is usually in the form of pellets, which occasionally lodge among the scale leaves, and so serve to indicate that a larva is at work. Sometimes the excrement is in strings, and if these lodge on the shoots one may find the caterpillar without difficulty.

When first born the caterpillar is yellowish-green or gray-green, but soon becomes brown, marked with a creamy-white line on the latero-dorsal ridge. This is an excellent protection at this time while the larva is feeding on the brown needle bundles, and the same colour marks it with very little change until after the second moult. When the needles begin to thrust their tips beyond the sheath the caterpillar ascends to the lowest visible green tissue, and bores into it in a manner which causes the tip to drop away. This wastefulness possibly protects the insect from enemies other than the entomologist, but for him is a good guide in the search for caterpillars. (Fig. 3.)

Soon after the second moult the larva becomes green, with pronounced white stripes, and at the same time alters its method of feeding. Ascending to the tip of a young needle, it begins to devour this, and

*With the first larvæ raised in the laboratory I experienced some difficulty. Several of them insisted on boring into the exposed stem, and were promptly drowned in the sap which flowed from the wound. Dr. Jas. Fletcher writes me that he has lost young caterpillars from the same cause. This can hardly be regarded as a natural point of attack, as it is invariably fatal.

gradually works downward until it encounters the brown sheath. It then begins on a new needle. In the laboratory the caterpillars frequently ate all the needles of a cluster, and showed no disposition to wander from the first shoot supplied to them, frequently cleaning up the very last bit of food before they sought another shoot. In nature I have never found more than three or four neighbouring bundles which showed signs of attack, and when the needles had grown to a length of an inch or more and had begun to diverge, seldom more than one of them in any bundle had been eaten. This would argue that the larvæ move about so that their depredations, by not being too marked in any one place, may be the less easily noticed.

My records show some discrepancy in the number of moults. The larvæ brought from Lakewood moulted four times before pupating, and yet I am certain that I had a memorandum of only three moults passed by the Albany larvæ raised some years ago. The loss of my material makes it impossible to compare the size of the heads of the two sets of caterpillars, but I shall endeavour to verify this observation at some future time. In the last two stages the feeding habit is quite unique, and has resulted in a structural modification. The caterpillar clings to the side of a needle and bends its head and first segment at right angles to its body, as illustrated in fig. 4. The structure of the first thoracic segment of most of the *Lycænidæ* is rather peculiar, the anterior edge being greatly swollen, the posterior half partially concealed by the segment behind. Just in front of the thoracic shield the segment is deeply creased. In *niphon* this crease is almost obliterated, and the white shield is drawn out from the protecting second segment so as to be entirely visible.

(To be continued.)

NOTICE OF NEW NAME.

Ceratina Cockerelli, new name for *C. lunata*, H. S. Smith (*non* Friese), Trans. Am. Ent. Soc., XXXIII, p. 119, April, 1907. The name *lunata* is preoccupied by Friese for an African species, in Wiener Entomologische Zeitung, XXIV, 1905, p. 10.

HARRY S. SMITH, Lincoln, Neb.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 22.

THE WALKING-STICK INSECT (DIAPHEROMERA FEMORATA).

BY J. B. WILLIAMS, F. Z. S., TORONTO.

We are all familiar with examples of protective colouring among the Lepidoptera. Moths on the upper side and butterflies on the under side of the wings frequently show a close resemblance to the bark and leaves of the trees and shrubs on which they settle.

In two families of the Orthoptera this principle is carried to a remarkable extent, and many of the Mantidæ or "Praying Insects," and of the Phasmidæ or "Stick Insects," are strikingly modified, both in form and colour, so as to resemble the natural objects with which they are surrounded.

The Mantidæ are carnivorous insects, and their leaf-like appearance assists them in the work of destroying other insects. The large front legs, armed along their edges with rows of terribly destructive spines, are generally held up in front as if in an attitude of supplication or prayer.

The Phasmidæ, on the other hand, live altogether on vegetable food, and their resemblance to vegetable forms serves only for protection against their enemies, and not for destruction.

Their eggs are laid each separately in or on the ground, while those of the Mantidæ are laid in clusters attached by an adhesive gum to the stalk of a plant.

Some of the tropical Stick Insects are nearly a foot in length, and almost as thick as one's little finger, but our Canadian species *(Diaphero-mera femorata)* is a little over three inches long and about the thickness of a small twig.

My acquaintance with this "Walking-stick Insect" began nearly twenty years ago, when a friend near Toronto sent me about a dozen live specimens. I kept them during the summer in a glass-sided case with a woven-wire top, and they laid a number of eggs, some of which I sent to the Zoological Society of London. These were hatched and successfully reared in the insect-house at the Regent's Park Gardens.

From a short account published in the Society's Proceedings for 1890, it appears that the first specimen emerged on the 11th of June, and others from time to time during the summer. They were fed upon hazel-leaves, and changed their skins four times before reaching maturity.

Since then I have kept and reared a number of them at different times, and though they feed on a variety of leaves, hazel-nut bushes seem to be their favourite resort, at any rate, in Canada.

The young ones at first just nibble off the green upper surface, but after a few days are strong enough to eat along the edge of the leaf. They are of a pale green colour when first hatched, and do not altogether lose this tint until the last change of skin, when they alter a good deal in appearance and gain considerably in size. Some of the females retain the green colour through life, but most of them take some shade of brown when they reach maturity.

They are rather "thirsty souls," and always seem glad to bend their heads down and drink if water is sprinkled on the leaves where they are feeding.

Their feet are furnished with hooks and pads, so that they can walk along rough or smooth surfaces in any position, and they hold on very tenaciously, so that a sudden jerk or pull will often break off a limb ; but such a loss does not seem to trouble them, and if this occurs before the final moult, a new limb will come at the next change of skin, though the new one is rather smaller than its predecessor.

When resting, the front legs are generally stretched out on either side of their long antennæ, and the legs and antennæ together greatly resemble a tuft of spicules fallen from the fir trees, that often grow over the bushes where they feed.

They take about six weeks to arrive at the adult state, and lead very harmless and inoffensive lives. The males have a well-developed spur on their centre and rear legs, but I never saw them make any use of it. They sometimes wave their front legs at each other when they meet face to face, but whether this is an angry or peaceful salutation I do not know.

Females sometimes emit a drop of fluid from the mouth, or rather from glands behind the mouth, when suddenly taken hold of ; and when alarmed they frequently feign death—dropping to the ground and lying on their backs, with their legs standing out stiffly at all sorts of angles—and they will sometimes lie in this way for a quarter of an hour, or twenty minutes.

Their eggs look very like hemp seeds, and the females make no effort to deposit them in any particular spot, just letting them drop on the ground beneath where they are feeding.

The often feed during the night, but take meals in the daytime as well. In fact, they are enormous eaters, though they make but a poor show for it all, and hardly look as if they had any stomach to put food into.

All of them die off about the end of October, so that one generation never sees anything of its successors, and the males begin to go first. I have seen females late in the fall, when egg-laying was over, with the abdomen split open like a dried-up seed-pod. Thus their preparation for death, their appearance in life, and the eggs from which they are produced, all bear some odd resemblance to the vegetable kingdom.

They are not generally very plentiful in Ontario; about a dozen are as many as one can usually find in an afternoon's search around Toronto, and sometimes that number is not seen during a whole summer.

In 1904 they were unusually numerous, and at Niagara Glen they became quite a plague. I was at the Glen on Sept. 23rd, and could have taken them in hundreds. At the north end, where they were most plentiful, many of the bushes were quite stript of foliage, and even some large trees had been altogether denuded of their leaves. On one lofty tree, whose top still retained a little foliage, a mass of them, almost covering one side of the trunk, reached from the ground as far up as the eye could see. Some constantly ran across the paths, so that it was difficult to avoid treading upon them, and a continual dropping could be heard as they, or their eggs, fell from trees and bushes. They were nearly as numerous in 1906, and again did a great deal of damage to the trees and shrubs.

A female that I kept at Montreal from Sept. 3, 1894, to Oct. 8, when she died, laid in that short time 112 eggs.

Some eggs that I obtained in 1904 came to nothing in the following summer, though I watched them till the middle of August. I then put them away in a box, and only on looking at them again, about a year after, did I discover that they had hatched the second year, for the box was full of the remains of infant Stick Insects, that had, of course, all perished for lack of food. I had quite forgetten the occasional occurrence of this delay in hatching, but it was vividly impressed upon my mind by the untimely end of these poor little creatures.

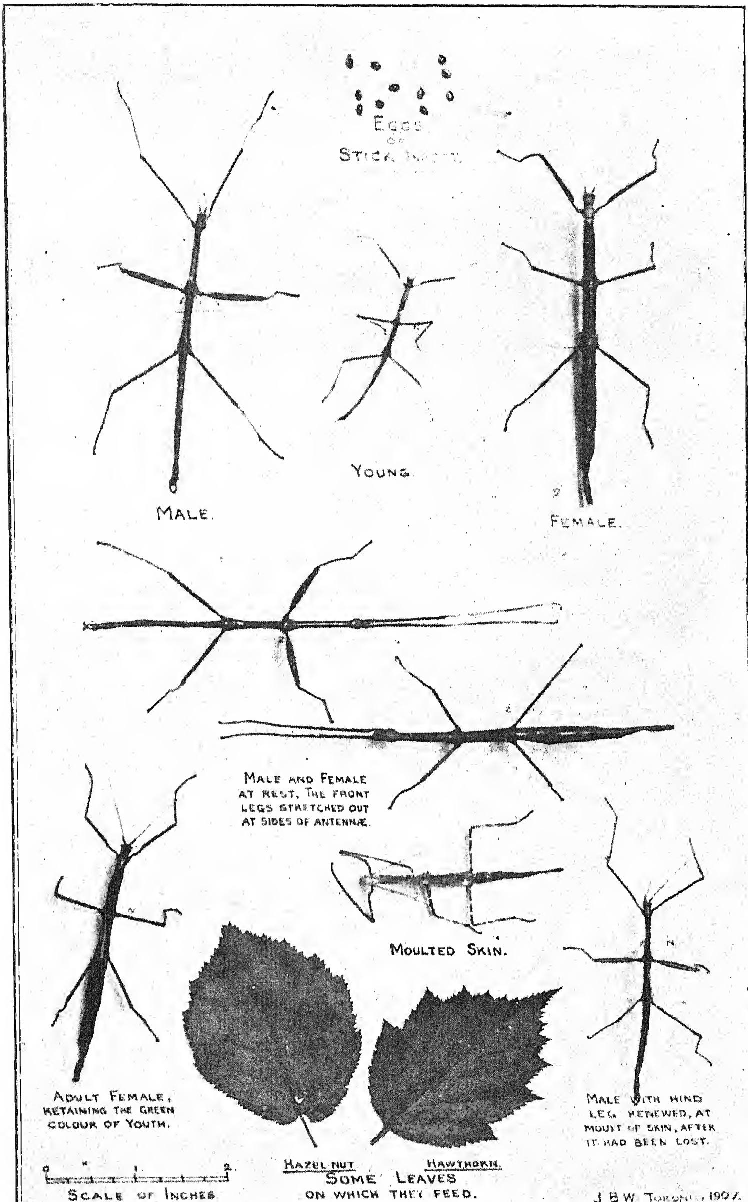
The illustration, I think, hardly needs further explanation; the specimens were all taken at Niagara Glen. Unfortunately, the photograph makes the pale green female look darker than the brown ones, instead of lighter, as in the actual specimens.

INTERNATIONAL CONGRESS OF ENTOMOLOGISTS.

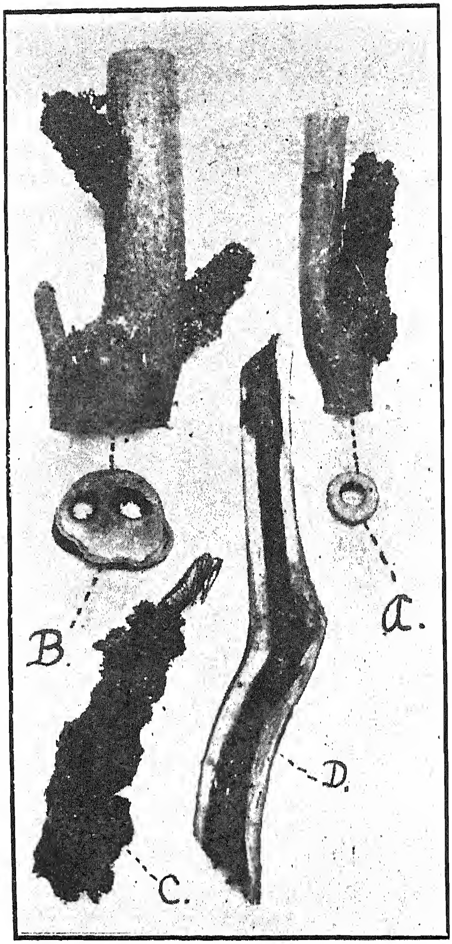
A number of eminent Entomologists in various countries have agreed upon the issue of an invitation to Entomologists in Europe and America to attend an International Congress of Entomologists to meet in 1908. The purpose of the Congress is to promote the interests of entomological research and of Biology in general, by furthering cordial co-operation between the Entomologists of different countries; stimulating research and directing it into channels where it may be most fruitful, or where special research is most needed. Questions of Applied Entomology will likewise be dealt with in the discussions and lectures, the large experience of pure Entomology being applicable with profit to Economic and Hygienic Entomology. All interested are cordially invited to advise and assist in the organization of the Congress. Communications should be addressed to Dr. K. Jordan, Zoological Museum, Tring (Herts), England. The following Entomologists have already signified their support of this movement, and are desirous that the officers and members of the Entomological Society of Ontario should co-operate in the work:

Chr. Aurivillius, E. L. Bouvier, L. Bedel, Th. Becker, I. Bolivar, M. Bezzi, S. Bengtasen, C. T. Bingham, J. C. Bradley, W. Beutenmuller, C. J. S. Bethune, C. H. Carpenter, G. C. Champion, T. A. Chapman, T. D. A. Cockerell, Ph. P. Calvert, K. Daniel, F. A. Dixey, E. C. Van Dyke, Ed. Everts, A. Forel, J. Fletcher, H. C. Fall, C. G. Gahan, A. Giard, R. Gostro, L. Ganglbauer, F. Ducane Godman, W. Horn, A. Handlirsch, H. Druce, W. L. Distant, K. M. Heller, Sir F. G. Hampson, G. von Horvath, F. Klapalek, P. Mabille, J. C. U. de Mejere, A. L. Montandon, P. Magretti, P. Merrifield, L. W. Mengel, Ch. Oberthür, R. Oberthür, H. Osborn, P. Pavesi, H. Rebel, F. Ris, R. B. Poulton, W. Rothschild, H. Schoutenden, F. Silvestri, M. Standfuss, G. Severin, Y. Sjöstedt, A. von Schulthess-Rechberg, J. B. Smith, H. Skinner, J. W. Tutt, G. H. Verrall, E. Wassmann, Chas. O. Waterhouse.

ERRATUM.—Page 228, line 13 from the bottom, for "Blanfort, S. C.," read "Beaufort, N. C."



THE WALKING-STICK INSECT, *Diapheromera femorata.*



PERSIMMON BORER, *Sannina uroceriformis.*

Work of the larva: *a*, cross-section of the stem above; *b*, cross-section of stem; *c*, cocoon, 2½ inches long; *d*, portion of stem showing burrow. (Photo. by author, reduced one-third.)

NOTES ON SANNINA UROCERIFORMIS.

BY GLENN W. HERRICK, AGRICULTURAL COLLEGE, MISS.

During the spring of 1906 one of my correspondents sent me two battered and broken female moths of the family *Sesiidæ* from Ocean Springs, Miss. Supposing them to be from the Peach tree, and from their battered condition not being able to make out their markings distinctly, I called them *S. exitiosa*. Having occasion to visit the fruit farm of this correspondent this spring, I was surprised to find that the moths in question were collected from pupæ on wild Persimmon trees. It was therefore with a good deal of interest that I began a careful examination of the few wild Persimmon trees on his place, and other trees of the same kind in the vicinity. This was on May 4. We were much disappointed at first in our search, because we found only empty pupa-cases, from which the adults had already and very lately flown. We found over twenty empty cases on about a dozen trees, from one inch to two inches in diameter. We were finally rewarded, however, by finding three or four fresh pupæ in some trees which had their bases heaped about with dead straw. From these we went to adjoining fields, where there were a great many small Persimmons, from one-half an inch to an inch and a half in diameter, that had been allowed to grow up in abandoned waste fields. Here among the deep grass around the bases of the trees we found twenty-odd living pupæ.

The larvæ of this moth bore into the solid wood of the taproot and stem of the Persimmon. I was unable to trace their burrows farther than eight or ten inches below the surface, but this was probably due to the small size of the trees, for Dr. Riley says they bore from 16 to 18 inches below the ground.

In most of the trees examined, one borer only was present, and in this case it usually bored directly up the centre of the tree (Plate 8, a and d). In larger trees two or more borers might be present, depending upon the size of the trees. In such instances they divide the space between them (Plate 8, b).

When ready to pupate, the larva extends its burrow two to four inches above the ground, turns it outward, cutting through the bark, and constructs a large cocoon on the side of the tree, usually at an angle of about 45° to the stem (Plate 8, c). The cocoons are dark in colour, and vary all the way from one inch to two and a half inches in length. The cocoon at c is two and one-half inches long.

The pupæ possess the power of movement to an astonishing degree, and when disturbed back quickly downward into their burrows. This is so characteristic of them that we were obliged to approach a tree rather carefully, and quietly tear away the grass and debris around the base without disturbing the cocoon if we wanted to be sure of our specimen. I lost some entirely, and cut others in two just as they were backing from their cocoon into the burrow in the tree. Again, so many pupæ backed out of their cocoons after the latter were removed that they dried out and failed to transform.

The records of the appearance of the moths are as follows :

Many empty pupa-cases found May 4.
One male May 8.
One female May 8.
One male May 9.
One female May 10.
One female May 11.
One male May 13.
Some are yet to transform (May 18).

These borers must injure the native Persimmon much more than a Peach-tree borer does a Peach tree, although I found no borers in large trees. They seemed to be confied to the young and small trees.

It is also an interesting fact that we were unable to find a single borer in the cultivated Japanese Persimmon trees standing in close proximity to the wild infested trees.

MOSQUITO NOTES.—No. 5.—Continued.

BY C. S. LUDLOW, M. SC.

Laboratory of the Office of the Surgeon-General, U. S. Army, Washington, D. C.

Among the mosquitoes sent in during the collecting period of 1906 in the U. S., was an Anophelina which has caused me some perplexity. The general colouring at once suggested one of the *sinensis* group, and it occurred to me that some joke had been perpetrated, so I wrote the collector, asking if it were possible that any Philippine mosquitoes had gotten in with these. He, however, said it was quite impossible, as he had no P. I. mosquitoes with him when this collection was made. No specimens resembling this had previously been received from the U. S., so that I was somewhat reluctant at first to accept it, but as closer study shows it

to be an *Anopheles* (as restricted by Theobald), and none of that genus has been received from the P. I., I have decided to publish it.

Anopheles perplexens, n. sp.—(Female.)—Head dark, with dark brown and white fork scales, the latter nearer the vertex, and a heavy tuft of slender, long curved white scales projecting cephalad between the eyes; antennæ dark brown, verticels and pubescence dark, basal joint brown; palpi dark, covered with dark brown scales, a small tuft of white hairs at the very tip; proboscis dark with dark brown scales, tip testaceous; clypeus dark, eyes brown.

Thorax: prothoracic lobes testaceous, with dark hairs; mesonotum with broad, light median stripe, covered with white "frost," and white hairs arranged so as to suggest a "part," a dark median line extending half way to the scutellum, and two dark lateral bordering lines; more or less of a tuft of these hairs at the nape; laterad the dorsum is dark brown, with dark brown hairs; pleura brown; scutellum testaceous, "frosty," with brown bristles; metanotum dark brown.

Abdomen dark brown, with light hairs (no scales).

Legs: coxæ and trochanters light, mostly light scaled; femora ventrally light scaled, and extreme tips of femora and tibiæ ochraceous, remainder of legs dark brown; ungues simple.

Wings clear, and rather heavily clothed with dark brown scales, except a few small ochraceous spots—one on the costa, just interior to a line drawn through the junction of the branches of the fork cells, a second tiny spot at the junction of the first long vein with the costa, extending a tiny bit on the long vein, and two very small faint light spots on the forks of the fourth long vein, also a tiny fringe spot at the distal end of the third long vein; halteres with light stems and fuscous knobs.

Length, 2.5–3 mm. Habitat, Camp Roosevelt, Mt. Gretna, Pa. Taken August 25, 1906.

This interesting species was sent by Capt. E. B. Whittemore, Asst. Surg. U. S. Army, and, as will be seen from the description, bears a closer resemblance to tropical Anophelina than to those so far reported from the U. S., but as the group it most closely resembles has abdominal scales and rather broader wing-scales it cannot be referred to it.

It seems wise to call attention to some variations occurring in Philippine mosquitoes. Among the *Myzomyia Ludlowii*, Theob., from the Province of Batan, Luzon, and in some collections sent from the southern islands, come specimens showing much more extended speckling

of the legs than in those I took in Batan in 1901, or in those taken in Abra, and which were sent to Mr. Theobald for identification. In these earlier specimens the yellow spots on the legs are practically confined to the femora, tibiæ and metatarsi, and this is the case in many specimens still sent in, but in the collections referred to the spots extend well on to the tarsal joints, so that the last two are often the only ones lacking them. The femoral spots are in some specimens nearly white, and all of the legs are marked, the fore legs as prominently as the others. This difference is so noticeable as to be misleading, but there can hardly be doubt that, as the insect in other respects corresponds closely to *Ludlowii*, it must be regarded as merely an individual variation, not even worthy of place as a "variety."

Some of the specimens of *Ædeomyia squammipenna*, Arribalzaga, coming from the P. I., show marked variation from the type, and yet, as these differences vary, can only be counted as individual differences ; the palpi in some specimens have ochraceous instead of white scales near the base ; the wing markings vary much as to size, and, incidentally, a little in position ; the white leg-bands are often broader, and the distal tarsal joint on the hind leg is frequently pure white. Of course, if these differences ran true, they would suggest a new species, but as they do not, are only of general interest.

Some time since my attention was called to a general resemblance between *Tæniorhynchus argenteus*, mihi, and *Culex gelidus*, Theobald. I have therefore compared the two carefully and find the following differences : As to proboscis, *C. gelidus* yellow, with a brown band near the apex ; *T. argenteus* brown, with broad white band. As to thorax, *C. gelidus* has a heavy white marking extending about two-thirds the length of the dorsum, the caudad third being of the yellowish-brown of the scutellum. *T. argenteus* has the white marking extending over the whole mesonotum and scutellum, with the exception of two oblong spots near the caudad end of the mesonotum. These seem to differentiate the insects, and there are besides these some scale differences which seem to throw it into *Tæniorhynchus* instead of *Culex*.

Megarhinus LeWaldii, mihi, to conform to the binomial nomenclature, must be written *M. Lewaldii*.

Long study and acquaintance with *Myzomyia Rossii*, var. *indefinita*, mihi, has convinced me that it should never have been referred to *Rossii*, and that it must stand as a distict species—*indefinita*, Ludlow.

NEW HISTORIES AND SPECIES IN PAPAIPEMA (HYDRŒCIA).

BY HENRY BIRD, RYE, N. Y.

(Continued from Vol. XXXIX, p. 141.)

The quest of unknown larval histories in *Papaipema* caused a trip to extend over the Alleghanies in 1905, as that elusive Noctuid, *P. furcata*, Smith, had been reported in several mature examples from the Pittsburg district, and we found a subtle enticement in the direction of possible clues. An offer of hospitalities by the genial F. A. Merrick in order to explore the New Brighton section, from whence so much that is good and rare obtains, met with a hearty acceptance. So, one happy July day, we were introduced to the beautiful woodland glades of Western Pennsylvania that are favourite haunts of our host. The rich soil of the valleys supports a luxuriant flora, and the new varieties of plant-life gave a welcome opportunity for examining unfamiliar forms suitable for the boring of *Papaipema* larvæ. A very few minutes afield sufficed to disclose an unknown desideratum, and its abundant occurrence in a plant never before examined soon made it apparent that another preferred food-plant can be added to the already extensive list. Of course, it was hoped that the newly-found larva might prove to be the desired *furcata*, though there was no surprise ultimately when this did not occur, nor was there disappointment that we never met with it in this or the succeeding year's search. To go out and pick up in five minutes the desired larva of a species, whose life-history is unknown, in no way accords with previous experience, and there was only an added zest upon each failure, as to whether we will meet it in five years or ten. This new food-plant which has furnished an unknown larva is *Podophyllum peltatum*, commonly known as May-apple or Mandrake. It is widely common in rich woods in the east, but through a proximity to the seaboard it had never been noticed at Rye. The absence of the plant here is the excuse for overlooking what appears to be a very prevalent *Papaipema* species. The plant is of a noxious character, shunned by cattle, and sends up from a running rootstock large five- to seven-fingered leaves, borne singly upon fleshy stems. Its foliage seems very free from any insect ravages, being, in fact, poisonous; the root has drastic medicinal properties, while an anomaly is shown in the edible fruit. One other good thing to its credit is the sheltering of a *Papaipema* species.

About forty half-grown larvæ were transported to the home colony, from which four imagoes appeared. The following year the larvæ seemed less numerous, yet Mr. Merrick secured a number of the moths.

It was fancied at first that some relationship could be established with *Harrisii* or *rutila,* but this failed in a careful study of details, and it therefore becomes necessary to advance a distinguishing name.

Papaipema Merriccata, n. sp.—Form and habitus normal; ground colour sordid chrome-yellow, or tawny. Head, thorax and primaries heavily powdered with purplish-brown scales. Abdomen and secondaries much lighter and devoid of the pronounced yellow tint. Head and collar of the same shade of purplish-brown, the latter edged above with yellow. Anterior tuft and patagia heavily scaled in the same colours. Primaries not contrastingly marked, a white scale at base; basal area tawny-yellow, never white; t. a. line of the usual irregular course, enclosing a dull purplish area; t. p. line plainly geminate, always broadly out-curved over the cell. The median field shows the yellow ground colour most strongly; the median shade line is brown, most distinct in lighter specimens, and is traceable to the lower end of reniform. S. t. line as usual, irregularly dentate, the subterminal space entirely purplish, though tempered from much contrast by the general powdering of brown scales. Outwardly this line is illumined by yellow scales defining the terminal space, which is lighter than the subterminal, excepting the usual light yellowish patch at the apex. Reniform moderate, broken by the veins and white, except the upper outward portion and the central lunulate mark, which are of the ground colour. Orbicular rounded and white; claviform separate, double, the lower half about the size of the orbicular. The veins are discernible on the secondaries, being outlined by darker scales; occasionally a median line may be traced, followed by a faint clouded band. The male structures, while typical, offer some points of individuality; the clasper is not prominently toothed outward, as with *rutila* and others, and the lower lobe of the harpes is bare of the usual spinules. Expanse, 34–43 mm.; 1.34–1.75 in. Thirteen examples, embracing both sexes, are at hand. Co-types will be placed in the British, the U. S. National and the Merrick Museums.

The species approaches *rutila* closest superficially, and might easily be considered a variation of the imago at first glance. It is presumed, of course, that we have the *rutila* of Guenée properly identified in the form occurring commonly in the Montreal section, and which has been repeatedly confirmed by comparisons with the type. Had Guenée only known and have given the name of its food-plant, how little else would be needed! In any event, *Merriccata* is distinct from that species, being relatively larger, less brightly coloured, structurally different in the male

and separable in the larva. The natural food-plant of *rutila* has not been determined, but it flourishes in burdock and thistle, and did the New Brighton species subsist in such commodious plant-stems we should certainly meet with moths having a greater expanse. As it is, Mandrake roots are so small, larvæ have been seen stalled and unable to survive, so tightly were they wedged in their galleries. The young larvæ evidently emerge about the second week of June, and mature from ten days to two weeks later than *rutila* and *Harrisii*. Entrance is easily made at any part of the juicy stem, and work soon gets down to the root proper. The original aperture is preserved and enlarged, being used long after a lengthy tunnel has been made in the root. The larvæ belong to that major section wherein the dorsal line is alone continuous and unbroken. The following is descriptive of the three final stages, which are the more important ones :

Stage V.—Form cylindrical, characteristics typical. Head 1.8 mm. wide, a faint dark line extends from ocelli to edges of thoracic plate, and is there dimly continued. Body colour pink ; dorsal, subdorsal and substigmatal lines pale yellowish, the last two broken at the first four abdominal segments. Tubercles normal, the accessory tubercle IV*a* occurs on joint ten, above the line of the spiracles. On joint twelve the large anal plate is preceded by an elongate plate, the merging of I and II from both sides. The tubercles are brownish, the spiracles black.

Stage VI.—Similar, the colour a little faded. Head, 2.5 mm. wide, side marking lost. Tubercles I and II are concolorous, and definable only by their setæ to joint eleven, where they appear in the usual quadrate setting. On joint ten, IV*a*, as before. This stage is reached about July 23, when such early species as *purifascia*, *circumlucens* and *nelita* have left their plants for pupation.

Stage VII.—Little change, except that the colour fades to a flesh-tint and the lines are lost. Head, 2.7 mm. in width. Tubercle IV*a* on joint ten the same as before ; does not bear a seta. Length from 38 to 43 mm.

These larvæ became mature about Aug. 10, and left their burrows in order to change to pupæ. The latter offer no individual features. Dates for emergence range from Sept. 8 to 30.

In the season of 1906 *Papaipema* studies received a local impetus through the discovery on the home preserves of an unknown, distinctive, and never-before-seen species, that savoured of interest the moment its larva was observed. Of course there are plenty of species whose larvæ

are unknown, and it might be any of these, but its peculiar workings and choice of food-plant at once suggested the unusual, which was finally borne out at emergence. In choosing *Collinsonia Canadensis*, the larva takes up with a common and generally accessible plant, and why the moth has not been observed before is one of the mysteries. How an insect of its size and appearance, with larvæ actually at work within the confines of New York City, and whose range must extend widely over the Eastern United States, could have escaped notice until this late day is most remarkable, for it does not appear in collections standing erroneously under some other label, as do the other species here brought forth. It simply does not occur at all. Some recent discussion over what is a rare butterfly, etc., recalls that inaccessibility or remoteness of habitat are often the main features of so-called rarity. In this case we certainly cannot make any excuse for inaccessibility, and while there is no claim made for its rarity in nature, we do say it has proved our most elusive Noctuid.

Collinsonia sends up a modest stem to the height of a couple of feet, from a very peculiar rootstock. It has very aptly received the common name Stone Root, for the roots are almost "as hard as a stone," being quite comparable to a piece of well-seasoned hardwood. That the larvæ forsake the fairly commodious stem and endeavour to make an impression on the root, was what drew particular interest to it. By maturity these endeavours have borne some result, and a little cell large enough to crowd in has been formed. In looking for something easier the epidermis is pierced repeatedly, so that the cell is often incomplete by reason of these broken tissues. But there is some flavour in Stone Root particularly enticing, for the larvæ of two other species are found to work in it in a very similar manner. One of these has a larva so close it is not at first recognized as different, and the other, the ubiquitous *cataphracta*, is always intruding itself into better company. Indeed, it is a "sly" borer, as it would make *nitela* and *cataphracta* its scapegoats, maturing early, forsaking the plant for pupation, and leaving these two later-appearing species that pupate in their burrows to take the brunt for the damage which is ultimately blazoned in the dying stem. Lucky were we to secure one inflated specimen and to carry through one other to imago. Even with the limited material and but one year's data, there is sufficient to warrant the following description :

Papaipema astuta, n. sp.—Form and habitus fully congeneric ; ground colour chrome yellow, a little brighter than *Merriccata*, and the powdering of brown scales not so heavy. Head and collar purplish-brown, no white scales at the base of the antennæ nor at the base of the

primaries. The prominent thoracic tuft and vesiture heavily scaled in purple-brown and yellow. Abdomen the same silken shade of pale fawn as the secondaries. Basal area of primaries small and of the ground colour, the outlying area to the t. a. line dull purple; median space entirely of the yellow ground colour, and contrasting at the t. p. line, as the remainder of the wing is quite dark. The median shade is a fine brown line extending from the middle of the inner margin to the lower end of reniform, whence it angles and crosses the cell to the costa in an unusually irregular course. The t. p. line is nearly straight, geminate, the inner a fine brown thread, the outer blended and lost in the deep purple of the subterminal space. This area is glistening, violet-purple, and adds greatly to the attractiveness of the insect. The very irregular s. t. line borders a rather wide terminal space of the dull purple that holds inside the median field. The ordinary spots are small; the orbicular and claviform are three, almost equal, superimposed spots, the former a pure white round dot, the latter double, the upper yellowish and the lower a pure white oval dot. Reniform broken, the commingling spots yellow, except the lower inner one, which is white. There exists the customary dash of the ground colour at the apex. Fringes deep purple and glistening. The secondaries scarcely show any terminal clouding, and have concolorous fringes. Expanse, 31 mm.; 1.25 in. The type is a female. Superficially it approaches *cataphracta* somewhat, though the straighter t. p. line, the small white-marked spots and the lighter secondaries easily separate it. Numerous *cataphracta* examples bred in *Collinsonia* show no change from the typical form, and appear nearly a month later.

Astuta larvæ were first observed July 10th, being then about half grown, and having emerged from the hibernated ova presumably about the first of June. The stems are entered three or four inches above, and the burrow is made downward to the root, which has been reached by this date. An inflate made July 20th shows a larva in the penultimate stage. Head, 2.2 mm. wide; normal, shining-yellow, without side line or shade; ocelli and mandibles blackened. Thoracic shield as large as head, black at sides. The longitudinal lines are barely seen, none of which cross the darkened area shown on the first four abdominal joints. The tubercles, though small, are black and easily definable. On joint ten, IV is low down, with no accessory, and is bare of setæ. On joints eleven and twelve the plates are normal. Length, 39 mm.

Pupation occurs in the ground, and the date of the single emergence is Sept. 12th. The pupa is light brown and active, and offers no feature of individuality.

The perusal of life-histories in this genus naturally brings out some features of distribution, which might not otherwise be obtained, one being that certain localities are favoured haunts of particular species, due of course to the prevalence of the natural food-plant, that may in an adjoining territory meet with restriction. So we have come to consider *necopina* and *duovata* as special Rye forms, never happening to observe them elsewhere. But the food-plant of *necopina*, Grote, is *Helianthus giganteus*, and is not confined to the seaboard, while closely-allied species of the plant occur commonly at all points. Being plants entirely suitable for *Papaipema* boring, all varieties have been examined repeatedly to discover if *necopina* ever changed its diet to any other, and this has been going on since the discovery of its larva in 1895. Never once in all this period have we been able to offer the slightest reflection upon its epicurean taste, so, when in 1906 *Helianthus divaricatus* was found bored at its base, with the familiar gall-like swelling there, it was presumed that the Grote species had at last been driven to the wall. These larvæ are still small, and have a continuous dorsal stripe which they should not possess, yet we are very willing to stretch a point, being eager, in fact, to encounter larval variation. We knew that the moment a pupa appeared we could settle the question, for *necopina* has a little frontal projection that is all its own. So when a very small chrysalis appeared undistinguished by any frontal development, it was known beyond question that we were not dealing with this species. The final emergence, however, produced a moth so like the Grote species that it was evident the common progenitor had not been very remotely removed down the line of evolution. What may have caused the new larva to have gained a dorsal stripe or to lose a frontal development in the pupa, should this be considered the branching species (in which the author hardly concurs), opens a field far too wide for discussion here. A description of the form, however, becomes absolutely necessary.

Papaipema imperturbata, n. sp.—Form fully congeneric. Ground colour very dark, almost black, with a brown or olivaceous reflection. The vestiture of head and thorax is of the one tone of ground colour, though grayer than the median field of primaries. The anterior tuft is of the usual prominence, though less adze-shaped than in many. The ally has an elongate, conical tuft, quite individual. Primaries almost uniform in colour, copiously powdered with blue-gray scales, the lines and markings obsolete. The subterminal space is obscurely evident, its blue tone

thoroughly tempered by the sprinkling of gray scales. Secondaries whitish, though clouded with dark gray at the margin. Beneath, this same light tone, overlaid by heavy powderings. No median shade observable in the series. Expanse, 28–32 mm.; 1.15–1.28 in. Six specimens, embracing both sexes, are at hand. Co-types will be placed in the U. S. National and the British Museums.

The species may be superficially separated from *necopina* in the moth state by its smaller size, lighter secondaries and bluer reflection of primaries. The male structures offer little of comparative value, being typical merely. The main characters will be found in the earlier stages, as already noted.

Larvæ were found to be in the fifth stage at the middle of July. They belong to the most prevalent, the *nitela-rutila* series, having the conspicuous dorsal stripe continuous. Its ally has this line broken in all stages. In the penultimate, which is the most important for comparisons, we find, for this section of the genus, a very representative larva. The colour is pale sienna, more livid than *Merriccata.* Longitudinal lines wide, straw colour. Head, 2.3 mm. in width; shining russet, no side line, mouth-parts and ocelli black. Thoracic plate as wide as head, shining, lighter in colour, edged with black laterally. True legs and spiracles black. Tubercles I and II show as the merest dots on all joints but eleven and twelve, where they are normal. Lateral tubercles small, though all are definable; IV on joint ten is low down, and has no accessory. Anal plate is small, rougher than thoracic. The dorsal line is very plainly shown for the stage, unbroken in its entirety. The other lines break from joints three to seven. Length, 40 mm.; date, July 20.

Pupation occurs Aug. 10–15; emergence, Sept. 9–20. The pupal change takes place in the gallery, which extends down to all parts of the root that are available, for the species is a gourmand, and it is hard to make one plant furnish enough substance. The amount of food consumed by different species is very striking. Some eat very little, others, most notably *cataphracta*, can be identified without ever being seen. *Imperturbata* enters but slightly above the root, and the plant, which is growing very fast at that time, makes an effort to counterbalance the boring by an elongate enlargement, that in the end furnishes considerable additional substance. The gallery goes upward also until the stem is eaten off and falls. An irregular opening is made for the moth's escape, which the epidermis is left to cover. This larva is not, however, so neat an artisan as *necopina* in making a doorway. The pupa differs upon comparison

from any of the four closely-allied species. It is normal, front smooth, the shape is most like *nelita*, though the latter is darker and less shining. The difference between *eupatorii*, *necopina* and *nitela* is obvious. Colour light chestnut, shiny. The two divergent, hooked anal spurs are relatively larger than its allies. Length, 17–18 mm. A very nice little *Sesia* is a co-labourer in the *Helianthus* root, and emerges just a few days ahead of its companion. An accident befell the one example carried through, so it is not known what species was represented.

(To be continued.)

THE *EUPITHECIÆ* OF EASTERN NORTH AMERICA.

BY GEO. W. TAYLOR, WELLINGTON, B. C.

(Continued from page 168.)

We have now to consider nine names proposed by Dr. Packard between 1867 and 1876, the date of his admirable Monograph.

The first in order of time is:

Eup. luteata,, Packard, Proc. Boston Soc. Nat. Hist., XI, 46, 1867.

Described from Labrador in the first place, but redescribed as *Eup. palpata* six years later from specimens collected in Maine and New York.

When Dr. Packard wrote the Monograph he placed *palpata* as a synonym of *luteata*, and I suppose the better plan is to follow him in this course. The descriptiou of *luteata*, however, seems to point to at least a distinct variety. The description given under the name *luteata* in the Monograph, it should be noted, is almost word for word a copy of the original description of *palpata*, and not that of *luteata*, as one might have expected. Dr. Hulst many years later described *Eupithecia ornata* from Colorado. This species is superficially somewhat like *palpata*, and Dr. Hulst named for various collections specimens of *palpata* as *ornata*. I have several specimens so misnamed by him in my own collection, and misled by these specimens I am afraid I have given this name (*ornata*) to many of my correspondents. Recently Mr. Swett has compared specimens for me with Packard's types, and he assures me that there can be no doubt that I have now *palpata*, that is, *luteata*, correctly identified.

The species seems to be common all through the eastern States from the middle of April to the end of May.

Eup. geminata, Packard, 5th Report Beabody Acad. Sci., 58, 1873.

Packard described the species from two specimens apparently not conspecific. The one, a male (figured in the Monograph at Plate viii, fig.

2), was probably a specimen of what in this paper I have called *coagulata*, Guenée, and the other, a female (Plate viii, fig. 3), would, therefore, become the type and take the name of *geminata*, but that the name is preoccupied by the *Eupithecia geminata* of Grote and Robinson. Under these circumstances, I propose the new name *Packardata* for *geminata*, Packard, part, and as Packard's description will not apply in its entirety, I have redescribed the form below.

Eup. Packardata, new name.

= E. geminata, Pack, not Grote and Robinson.

= absynthiata, Pack., Monograph, not Clerck.

Expanse, 27–30 mm. Males rather smaller.

Palpi rather large and coarse, very dark gray. Head paler than thorax, which is gray, with a brown shade, darker in front. Abdomen with a very distinct black transverse band on second segment.

Fore wings colour of thorax, costal spots not as heavy as in *coagulata*, the most distinct being the basal, intra-discal and extra-discal. This last is the largest, and is preceded by two smaller ones. Each of these spots marks the commencement of a fine line appearing only as dots on the veins, but in very perfect specimens the lines can be traced right across the wings.

The basal line is much curved, and reaches almost to the base on the inner margin. The intra-discal is almost straight, meeting the inner margin at right angles. Sometimes two other lines are visible between the basal and intra-discal lines. The three extra-discal lines are parallel, curving out from the costa to pass the large elongated discal spot.

The submarginal space is a little darker than the rest of the wing, and is sometimes bounded inwardly by a fine line parallel to the extra-discal. The submarginal white line is not so evident, and the twin spots are not so large and conspicuous as in *coagulata*. A dusky marginal line, scarcely interrupted at the ends of the veins ; fringe long, obscurely spotted.

Hind wings well rounded, a little lighter in colour than fore wings, discal spots very small. The wings are crossed by numerous dark wavy lines, about nine of these lines being sometimes visible; submarginal white line very faint, marginal line and fringe as on fore wings.

Under side of fore wing quite clear from base to extra-discal line, except for a single dark extra-basal spot on the costa, which does not correspond with either the basal or intra-discal costal spots of the upper side, but has a position between them. The discal spots, the extra-discal, submarginal and marginal markings are as above, but fainter. Hind wings,

discal spots more evident than above; and there are about eight cross lines traceable from margin to margin.

The dates of my specimens run from 10th June to 12th September. The species is very closely allied to *E. casloata*, Dyar, from British Columbia, and to *Eup. fumata* and *E. indistincta*, which will be described in the present paper. It is also near to *E. fumosa*, Hulst, as I understand that species.

I have little doubt that my specimens are conspecific with the type of *geminata*, Packard, figured in Plate viii, fig. 3 in the Monograph, but to guard against mistakes I have placed a type label on a very perfect specimen of *Packardata* taken at Ottawa (7, viii, '06) by Mr. C. H. Young.

Eup. palpata, Packard, 5th Rept. Peabody Acad. Sci., 58, 1873.

This species, as stated above, was abandoned by Packard himself as being the same as *E. luteata*.

Eup. interruptofasciata, Packard, 5th Rept. Peabody Acad. Sci., 59, 1873. Monograph, 52, Pl. viii, fig. 5, 1876.

This species was very fully and carefully described by Packard, and I think there cannot be any doubt as to the form he had before him when drawing up his description. It must be borne in mind, however, that he only distinguished 12 out of our 40 or more eastern species, and that his series under each name would, therefore, almost certainly be mixed. No weight, therefore, can attach to specimens distributed by Packard as *typical*, any more than to so-called authentic specimens of *misurelata*, sent out by Grote.

When writing the Monograph, Packard sunk his *interruptofasciata* as a synonym of *miserulata*, but in my opinion the two are abundantly distinct. I understand that the original types of Packard's species are not now in the collection at Cambridge. *Interruptofasciata*, as I have identified it, is not a very common insect.

My best specimens were bred by Dr. Fletcher from larvæ found on Juniper at Hull (Province of Quebec) in May, 1904 (see description of larvæ by Dr. Fletcher and note by me in CAN. ENT., XXXVII, 262). This species is an autumn flier. Dr. Fletcher bred specimens emerging in September. It is very closely allied to my *Eup. impedita*, to be described in the present paper.

Eup. Strattonata, Packard, 5th Rept. Peabody Acad. Sci., 60, 1873. Monograph, 58, Plate viii, fig. 8, 1876.

This species was described from one female taken by Stratton at Natick, Mass., on July 17th.

It is well described in the Peabody Report, but the description is shortened a little in the Monograph, and the figure therein is not very characteristic. The insect is apparently rare, and I have only a single specimen (which I owe to the kindness of Mr. Swett), taken at Winchendon, Mass., June 20th.

Strattonata cannot be mistaken for any other of our eastern species, the unusual colour (brownish-ochreous, Packard calls it), the heavily-marked costa, and the small but very distinct discal spots, readily separating it from its allies.

Why this species should ever have been placed on a synonym of *Eucymatoge anticaria* I cannot imagine. It bears very little resemblance to that species, and has the single accessory cell of *Eupithecia*, not the double one of *Eucymatoge*

Eup. fenestrata, Milliere, Rev. & Mag. Zool., 1874, p. 243, and Icon., iii, 431, 153, 14, 15, 1874.

=Larentia cretaceata, Packard, 6th Rept. Peab. Acad. Sci., 40, 1874, and Proc. Bost. Soc. Nat. Hist., xvi, Pl. i, fig. 3, 1874.

=Eup. cretaceata, Packard, Monograph, 63, Pl. viii, fig. 15, 1876.

=Glaucopteryx cretaceata, Packard, Monograph, 562, 1876.

There is a difficulty in recognizing this species, which, though described from Sierra Nevada, is equally common on the Pacific Coast and in the Atlantic States. There is no doubt, I think, that the *cretaceata* of Packard is at best only a variety of the European *E. fenestrata*, and in Staudinger and Rebel's Catalogue (No. 3589) the two are placed together.

I do not understand why Packard should have printed his description twice over in the Monograph (see pages 63 and 562).

Last autumn, in company with Dr. Dyar, we discovered the larvæ of this species feeding in great numbers on the flowers and seeds, and later on the leaves of *Veratrum viride* (the False Hellebore). The larvæ were about one inch in length, of a yellowish-green colour, with eight interrupted black lines, one dorsal, two lateral and one subspiracular on each side, and one ventral. The head and legs shining black. These larvæ were full fed at the end of August, and the moths are now (4th of June) emerging.

Eup, albicapitata, Packard, Monograph 48, Pl. viii, fig. 1, 1876.

This is one of the most distinct species we have in the genus, and the description of Packard is very good, though the figure is hardly so satisfactory. The moth is not very common or well known, and it is quite usual to find some very different species under this name in collections. *Albicapitata* flies in June, and it occurs on both the Atlantic and the

Pacific coasts. I have not, however, received any specimens from the Prairie Provinces. Mr. T. Bryant took a number of specimens near the British Columbian and Alaskan boundary in 1905, and it also occurs at Kaslo, in British Columbia. A specimen from the latter locality was inadvertently recorded by Dr. Dyar (Proc. N. S. Nat. Mus, xxvii, 889) as *laquæaria*, Herr-Sch., a species not entitled to a place on our American list. I have not seen many specimens from the eastern States, and Mr. Swett tells me that the species is not common, but is subject to considerable variation.

Eup. zygadeniata, Packard, Monograph, 51, Pl. ix, fig. 7, 1876.

This species was admirably described and equally well figured in the Monograph. The types were from Texas, and I have not seen specimens from any other State. Once seen, it cannot afterwards be mistaken for any other species. Nevertheless, it has usually been misnamed in collections. Dr. Hulst does not appear to have recognized it, for I have seen several specimens of other species (none of them really *zygadeniata*) sent out by him with this name on the label. As a result of these misidentifications the name, *zygadeniata*, has appeared on several local lists, but I should mistrust any record from localities other than Texas. My own specimens (all dated May, 1902) are from the type locality, and agree exactly with the original diagnosis. Judging from the description and locality, I should say that the "*Tephroclystis tenebrescens*' of Hulst (CAN. ENT., XXXII, 102) is a synonym of this species.

The spelling of the name seems to be a stumbling-block to the list-makers. It is spelt incorrectly in Hulst's "Classification" and in Dyar's and Smith's latest lists, and in each of these instances we are favoured with a different variation.

Eup. ravocostaliata, Packard, Monograph 60, Pl. viii, fig. 9.

Described from the Pacific Coast, and so well known and easily recognized from description and figure that a mistake with regard to it would be almost impossible. The species is not, I think, quite as common in the east as in the west, but it is found in more or less abundance in every locality from which I have seen collections.

Of Packard's nine species noted above, six will continue to bear his names. One *(palpata)* is sunk in deference to Packard's own opinion; one *(geminata)*, which had been placed in synonymy by Packard, is restored under a new name *(Packardata)*; and one *(cretaceata)* is dropped as being but a slight variety of a previously-described European species.

(To be continued.)

ENTOMOLOGICAL SOCIETY OF ONTARIO.

A summer meeting of the Society was held at the Ontario Agricultural College, Guelph, on Thursday and Friday, July 4 and 5. Through the kindness of President Creelman, the members from a distance were hospitably entertained in the College residence during their visit, the ladies of the party being provided for in the Macdonald Hall. The number in attendance was smaller than was anticipated, many who had been looking forward to taking part in the meeting being prevented from coming by a variety of causes. A very satisfactory audience, however, was made up by the Summer School of Ontario teachers from the Macdonald Institute, and several students and members of the College staff. The sessions began on Thursday afternoon in the lecture-room of the Biological Department, the President of the Society, Dr. Fletcher, of Ottawa, being in the chair. Mr. H. H. Lyman, of Montreal, read a paper on the distinctions between *Thecla calanus* and *Edwardsii*.

Dr. Brodie, of Toronto, described the life-history of a colony of the Tent Caterpillar, and related his experience in breeding a large number during a series of years in order to observe the effects of parasites upon them.

Dr. Fletcher gave an account of a visit he had recently paid to Massachusetts, and described what was being done to control the Browntail and Gypsy moths by the importation of parasites from Europe and by practical field operations.

Mr. C. W. Nash, of Toronto, spoke on "Balance in Nature," in which he described in a very interesting manner some of the numerous checks and counter checks which are provided in order to prevent the undue preponderance or the extermination of any particular species, and showed how this balance had been upset by man's disturbing agency, and the difficult problems that had arisen in consequence. A discussion followed, which was participated in by the chairman, Dr. Brodie, Prof. Bethune, Mr. Jarvis, Mr. Caesar, and others.

In the evening the session was held in the Nature-study lecture-room of the Macdonald Institute, and was attended by the Summer School and a number of others from the town and College, as well as by the members of the Society. Dr. Henry Skinner, of Philadelphia, gave a highly interesting lecture on "Insects as Carriers of Disease." Mr. C. W. Nash followed with a lively address on "Instinct vs. Education," and Dr. Fletcher spoke in his usual attractive manner on "Nature Study as a

Means of Education." The evening was thoroughly enjoyed by all present, and no doubt the school teachers carried away with them much information and many impressions that will be of value to them in the future.

The next day, July 5th, was given up to an excursion to Puslinch Lake, a picturesque sheet of water about nine miles from the College. The Summer School joined in the picnic, making up a party of more than sixty in all. The day was spent in collecting botanical and entomological specimens and other objects of interest. At the close short addresses were given by members of the College staff and others on various specimens that had been brought in, including fresh-water shells, insects and plants. The meeting on the whole was so delightful and successful an experiment that it will no doubt be repeated in future years, and become annually more attractive and well attended.

At a meeting of the Council, Mr. L. Caesar, O. A. College, was elected Secretary of the Society for the remainder of the year in place of Mr. E. J. Zavitz, who has found it necessary to resign, as his various duties in the department of Forestry leave him no time to devote to the business of the Society.

THE GEOMETRID GENERA ALSOPHILA, HUB., AND PALEACRITA, RILEY.

BY RICHARD F. PEARSALL, BROOKLYN, N. Y.

It would be supposed that the last word had been written about the canker-worms, the literature of which has been so confused, as well as the two species. Had attention been given but slightly to their structural characters, there had been no need of this. *Pometaria*, Har., is correctly placed, in my judgment, by Dr. Hulst in *Alsophila*, with *æscularia*, Schiff, as its type. He says (Trans. Am. Ent. Soc., Vol. 23, p. 258), "I cannot agree with Mr. Meyrick in his reference of this genus to the Monocteniinæ. The most characteristic venation is the merging of vein 8 of hind wings with the cell. If this is to be ignored, *the lack of the accessory cell* would be no more reason why it should be placed with the Monocteniinæ than with the Ennominæ." He might have gone further, for besides the merging of vein 8 with cell, vein 5 is present, and this effectually keeps it out of the Ennominæ, besides, it has an accessory cell, as has also the type. Hence the reasons disappear why it should not stand just where it does.

With *Paleacrita* the strange part of the present arrangement comes in. Here the type *vernata*, Peck., has the true venation of the Ennominæ,

with accessory cell rarely present in the fore wings, and it has vein 8 of hind wings running parallel with cell for half of cell's length, *not united with it*, while vein 5 is a fold only, sometimes faintly evident at wing margin, but disappearing before it reaches cell, or entirely absent. The antennæ, as Dr. Riley pointed out three years after he described his genus *Paleacrita* (8th Mo. Report, p. 15 and 17), are nearly in agreement with those of Erranis (Hybernia), but the spinose armature of the abdomen prevents the entrance of the species under that genus and their antennal structure from the genus *Phigalia*. *Paleacrita*, with the species under it, will properly, I think, find its place among this group of the Ennominæ, which also includes the genus *Conoides*, Hulst, with its wingless female, the type *plumigeraria*, having in both sexes the spinose armature of abdomen, a feature apparently overlooked by Dr. Hulst. In my opinion, *Paleacrita* should be placed at the beginning of the Ennominæ, followed by others of this group, in the same manner that *Alsophila* opens the series of Hydriomeninæ, for, it will be observed, the species under this genus show, in individual cases, a tendency toward the recurrance of vein 5. It is interesting to note that a common point is thus established, from which spring the two great divisions of the Geometrinæ, thus *pometaria*, purely Hydriomenid in venation of hind wings, sometimes loses the accessory cell in fore wings, while *vernata*, as purely Ennomenid in venation of fore wings and in the separation from cell of vein 8 in hind wings, does, in the latter, as I have stated, show an occasional vestige of vein 5. What Dr. Hulst says, following my quotation above, as to the noctuiform position of vein 5 under *Paleacrita* applies to *pometaria*, an observation even more strongly accentuated in the type species *æscularia*, of which, through the kindness of Mr. L. B. Prout, I have an example. Under *Paleacrita* there should be listed *four* species, viz., *vernata*, Peck.; *Merricata*, Dyar; *longiciliata*, Hulst, and *speciosa*, Hulst. The ♀ ♀ are unknown, except in the case of *vernata*, where both sexes have the abdomen spinose, but they are undoubtedly wingless in all. In the ♂ ♂ the antennæ vary in each, but may be generally defined as follows: Stalk long and slender, nodose on each side, with fascicles of long curved ciliæ from each nodule. In *vernata*, *two* on either side of each joint, *one* in each of the other species, hence the separation of *Merricata* as a variety of *vernata* and its establishment as a distinct species. In recent correspondence with Mr. Meyrick, he stoutly maintains this as his opinion also, and hopes to give its life-history in confirmation of it.

NUMBER OF MOULTS OF THE FEMALE OF *DACTYLOPIUS CITRI*.*

BY ROBERT MATHESON, ITHACA, N. Y.

The life-history of the male of *Dactylopius citri* has been worked out by Reed in 1890 at Cornell University. His results are embodied in an unpublished thesis. Berlese, '93, in "Le Cocciniglie Italiane Viventi Sugli Agrumi," pp. 23-33, has given a more detailed account of the male's life cycle. It may be well to give here a brief summary of their work before describing the transformations of the female:

The young nymphs moult for the first time in from 10 to 22 days after hatching. During the first stage it is impossible to separate the males from the females by their external characters, and only just previous to this moult can they be distinguished. Berlese has shown that the future mouth-parts of the female which is about to shed its skin, are coiled spirally just beneath the transparent cuticle. In the males no developing mouth-parts can be observed, and those which they possess disappear at the time of the first moult. These facts can be observed just before the moult.

The cast skins usually remain attached to the caudal extremity of the male nymphs. In the second stage the male nymphs are sluggish in their movements. They usually seek out some secluded spot and, in about ten days, begin spinning their cocoons. The spinning of the cocoon occupies about two days, and, shortly after its completion, the second moult occurs. This cast skin is, in a day or two, pushed out at the caudal end of the cocoon. It is during the second stage that the beginning of the wings and halteres may be noted. They appear as small papillæ on the mesothoracic and metathoracic segments.

The third moult occurs five days after the second, and a week later they moult for the last time. The perfect winged insects emerge from the cocoon in from three to four days after the fourth moult.

The life-history of the female is in marked contrast to that of the male. Neither Reed nor Berlese, nor any previous worker, succeeded in determining the number of moults in the female. Reed supposed there were three, whereas Berlese, reasoning from analogy with the male, considered there must be at least four.

*Contribution from the Entomological Laboratory of the Cornell University.

As is generally known, each female lays from 150 to 200 eggs. These eggs are enclosed in a waxy secretion, produced by hypodermal glands. These glands are situated on the ventral surface of the abdominal segments. The first nymphs appear in from 10 to 18 days after the commencement of the egg-sac. Only a small number of those hatched from a single egg-sac are males. The young nymphs on hatching remain a short time within the egg-sac, and, on leaving it, spread rapidly over the leaf, settling in large numbers along the mid-rib and at the joints of the stems. As previously pointed out, it is impossible to separate the males from the females during this stage.

First Nymphal Stage.

At time of hatching, the young nymphs are about .4 mm. long, and from .18 mm. to .21 mm. wide, bright yellow to orange in colour, oval in outline, slightly narrowed at the caudal end and rounded at the cephalic end. The appendages look large and clumsy in comparison with the size of the body.

The abdomen is distinctly divided into eight segments, the transverse sutures being distinct on both dorsal and ventral surfaces. The divisions of the thorax are not so distinct. The transverse sutures cannot be distinguished on the venter, and only with difficulty on the dorsum. The suture separating the head from the thorax can be seen only on the dorsal surface.

The antennæ are about .16 mm. long, situated on the ventral surface of the anterior end of the body. The bases of the antennæ are not contiguous, and small hairs are scattered over their entire surface. They are divided into seven segments. The basal one is triangular in outline and quite short. The seventh segment is the longest, longer than the three preceding segments taken together, oval in shape, and ends in an apical tubercle, upon which is inserted a stiff hair, almost as long as the segment itself.

The cornea of the eyes projects from the sides of the head. The black pigment is well developed, showing prominently on the ventral surface.

The legs are well developed and strong, especially when compared with their condition in the adult.

Second Nymphal Stage.

The first moult occurs from 10 to 22 days after hatching. It is just before this moult that Berlese could distinguish the males from the females by the absence of developing mouth-parts.

After the first moult the females are about .625 mm. in length, .3 mm. in width; bright orange in colour, somewhat rounded at the anterior and posterior ends.

The antennæ are .19 mm. long, and have seven segments. The basal segment is quadrangular in outline and quite short. The seventh is the longest, being nearly as long as the three preceding taken together.

It is difficult, if not impossible, to separate the first and second nymphal stages, except by rearing them and noting the time of moulting. The characters of length and size of the antennæ are of doubtful value, and not to be depended upon. The antennæ of a nymph, near the latter part of the first stage, measured over .19 mm. This is the length usually found in the nymphs at the beginning of the second stage.

THIRD NYMPHAL STAGE.

The second moult occurs, on the average, about 15 days after the first.

The antennæ now consist of eight segments, and are .264 mm. in length. The basal segment is quadrangular in outline, and the eighth is nearly as long as the three preceding taken together. The character and the number of the antennal segments readily distinguish this stage from the preceding ones, but are absolutely of no value in separating it from the mature or last stage. In other characters they do not differ materially from those of the preceding stages.

As all previous workers have considered the antennæ in the first nymphal stage as consisting of only six segments, I would like to draw attention to the fact that in all specimens which I have examined there were seven clearly-defined segments in the first and second nymphal stages and eight in the third, as well as in the adult female.

ADULT.—FEMALE.

The third and last moult takes place, on an average, about 13 days after the second. I found it very difficult to secure many observations on the exact time of this moult on account of the roving habits of the nymphs under observation.

After this moult the females do not usually move about, but remain practically motionless. Egg-laying commences in from 15 to 20 days later, and continues for from 10 to 14 days. An interesting observation worth recording is that the females are usually not of uniform size at the time when they commence egg-laying. This has been pointed out by Reed in his thesis, and I had many opportunities of verifying his

observations. Often what I, judging from size only, considered were nymphs in the third stage would prove to be mature females and commence egg-laying.

The formation of the egg-sac, the number of eggs laid, and the external characters of the adult female, have been so well described by previous workers as not to need repetition here.

BOOK NOTICE.

Kirby's Catalogue of Orthoptera.—Vol. II.

By A. N. Caudell, U. S. Nat. Museum, Washington, D. C.

Volume two of this most excellent general catalogue of Orthoptera* comprises a well-bound volume of over five hundred and fifty well-printed pages. In it 154 genera of crickets (Achetidæ) and 689 genera of katydids and allies (Phasgonuridæ) are listed, together with their species. The Achetidæ as here used corresponds with the more commonly used name Gryllidæ, while the name Phasgonuridæ is used instead of the more familiar name Locustidæ. The reason for the change of Gryllidæ to Achetidæ is not clear to me. As in the first volume, the types of all genera containing more than one species are indicated.

As of interest to North American students of this order, the following facts bearing on United States genera and species may be noted:

Locustidæ (Phasgonuridæ).

Microcentrum, Scudd.—This genus is used for the insects hitherto usually placed in the genus *Stilpnochlora*, which is here sunk in synonymy under *Microcentrum*. Kirby specifies his number 2, *thoracicum*, Serv., as the type, but erroneously so, as neither this species nor any of its synonyms are among the originally included species. Personally I should favour taking the first species, *retinervis*, as type, thus preserving the commonly-accepted nomenclature. By elimination the type is *marginellum*, Serv., which Kirby records only from S. and Cent. America and the West Indies. North America should be included, as *Microcentrum thoracicum*, Scudd., one of its synonyms, was described from the United States, and I have two specimens from Florida that agree with ones from Cuba. I also have eggs from Florida, showing the species to be a permanent resident there.

*A Synonymic Catalogue of Orthoptera. By W. F. Kirby, Vol. II, Orthoptera Saltatoria, part I (Achetidæ et Phasgonuridæ). London, 1906.

Orophus Sauss.—Under this generic name appears the aggregation of species usually listed under *Microcentrum*. Our common insect usually known as *Microcentrum laurifolium* is now *Orophus rhombifolium*, the true *laurifolium* being a species from Caymans, and belonging to the genus *Microcentrum* as here used. Our well-known *Microcentrum retinervis* now becomes *Orophus retinervis*, a change unnecessary were the first species rule a law.

Amblycorypha, Stal.—*A. Saussurei*, Bruner, I do not find in the Catalogue. It was very poorly described in Bull. Washb. Coll., i, p. 195 (1886), from specimens which the describer has recently written me were taken near Washington, D. C. The name should be entered in the synonymy under *A. oblongifolia*.

Cyrtophyllus, Burm.—This genus is replaced by *Pterophylla*, Kirby, described in Kirby and Spence's Introd. Entomol., ed. v, vol. ii, p. 218 (1828). *Camellifolia*, Fabr., is designated as the type. This species replaces *perspicillatus* of the same author. The *Gryllus perspicillatus* of Linnæus, wrongly quoted by Scudder as the same insect as the *perspicillatus* of Fabricius, is not, so far as I can find, mentioned in the Catalogue.

Conocephalus, Thunberg.—This genus is placed in the synonymy under *Anisoptera*, Latr., and the species so long associated with it are placed in the genus *Conocephaloides* of Perkins. The publication containing the original reference to *Conocephalus* is at present unavailable, and I am thus unable to determine if I agree in the suppression of the name or not. *Hebes*, Scudd., is listed as a distinct species, but is not marked as being present in the collection of the British Museum. As Scudder himself places this species in the synonymy under *nieti*, that is very likely its proper place.

Orchelimum, Serv.—*Vulgare*, Harris, usually listed as a synonym of *agilis*, DeG., is listed as a distinct species, and, I believe, properly so. *O. gracile*, Harr., is removed from the synonymy under *Xiphidion fasciatum*, where it is usually placed, and listed as a distinct species of *Orchelimum*. This I believe an incorrect step. No specimens of the species were before Mr. Kirby, nor is any insect known in the eastern United States that agrees with Harris's figure. The description given by Harris agrees very well with *X. fasciatum*, but does not agree with his figure, which represents the ovipositor as being decidedly falcate. The

figure is evidently inaccurate, and the species is very surely *X. fasciatum* with dorsal infuscation, a common variation. *O. concinnum*, Scudd., is catalogued as a distinct species. In view of the fact that Mr. Kirby seems to have possessed neither this species nor *herbaceum*, of which Scudder considers *concinnum* a synonym, I prefer to leave the former in synonymy under the latter. *Nigripes*, Scudd., is replaced by the earlier name *validum* of Walker. *Bruneri*, Blatchley, is listed as distinct, though the describer has pronounced it a synonym of *volantum*, McNeill, after direct comparison of types of both species.† *Sphagnorum*, Walk., described as a *Decticus*, and since omitted from American lists, is recorded. It will very certainly preoccupy some one of our later described species.

Xiphidion, Serv.—This well-known generic name, like *Conocephalus*, Thunberg, is in the synonymy under *Anisoptera*, Latr. The species placed here are those usually classed under *Xiphidion*. *Cinereus*, Thunb., is removed from the synonymy under *fasciatum*, though no specimens of it seem to have been before the cataloguer. There may, however, be good reasons for this action. As stated above, *gracile*, Harr., is listed as distinct. *Phaneroptera coloradensis*, Glover, Ill. N. A. Ent., Orth., pl. xi, fig. 12 (1872), is omitted from the Catalogue. It is a synonym of *fasciatum*.

Engoniaspis, Scudd.—This genus, as shown in my revision of the Decticinæ‡, p. 320, is a synonym of *Atlanticus*. I accredit it to Scudder, as I maintain that a generic name can not stand without a species being cited under it. The first species mentioned under the generic name *Engoniaspis* is *testacea*, Scudd., which is a synonym of *Atlanticus pachymerus*, Burm.

Atlanticus, Scudd.—The *Decticus derogatus* of Walker is quoted as a synonym of *A. dorsalis* instead of *A. pachymerus*, as is usually the case. The description of Walker gives no aid in the matter, but the locality, Massachusetts, would indicate its being *pachymerus*. Kirby had specimens of *dorsalis*, but none of *pachymerus*, and when he has specimens of the latter for examination his views on this point of synonymy may change.

†The Orth. of Ind., p. 390, 391 (1903).

‡Proc. U. S. Nat. Museum, xxxii, pp. 285–410 (1907).

Anabrus, Hald.—*Similis*, Scudd., which is here listed as distinct, is a synonym of *A. simplex*.

Cyphoderris, Uhl.—This genus is wrongly located in the Decticinæ. It is a genus in the Stenopelmatinæ.

Cacopteris, Scudd.—As shown in my revision of the Decticinæ, this is a synonym of *Idiostatus*, Pict.

Tropizaspis, Scudd.—This genus falls, as it is the same as Walker's earlier described *Neduba*, and the type, *steindachneri*, equals *Neduba carinata*.

Chelidoptera, Wesm.—This is preoccupied in birds, as stated on p. 403 of my recent paper on Decticinæ.

Idionotus, Scudd.—This genus is wrongly referred to the synonym under *Neduba*, Walk.

Camptonotus, Uhl.—For our United States species of this genus Mr. Kirby uses the specific name *Scudderi*, Uhler, 1864, instead of *carolinensis*, Gerst, 1860. As these names are admittedly synonymous, it is not clear why the one first established is not used.

Stenopelmatus, Burm.—*S. oculatus*, Scudd., and *hydrocephalus*, Brunn., are placed in synonymy under *cephalotes*, Walk., a species hitherto not found in our catalogues. These three species will very likely eventually fall through preoccupation by *fuscus*, Hald., which was described in 1852.

Diestrammena, Brunn.—Mr. Kirby has recorded no species of this genus as occurring in the New World. One species, however, *D. marmorata*, has occurred for several years in injurious numbers in Minnesota greenhouses, and another species, *D. unicolor*, has been recorded from Illinois, where it was introduced, probably, with plants.

Spilacris, Rehn.—This is a synonym of *Scudderia*, the type, *S. maculatus*, being an immature specimen of a species of that genus.

Hadenœcus, Scudd.—I do not find *H. puteanus*. Scudd., in the Catalogue.

Udeopsylla, Scudd.—*Gigantea*, Brunn., belongs to this genus, not to *Daihinia*.

ACHETIDÆ (Gryllidæ).

Gryllotalpa, Latr.—This familiar name is in part replaced by *Curtilla*, Oken, and in part by the new name, *Neocurtilla*, the latter covering those species having the posterior tibiæ unarmed on the upper border, typified

by *G. hexadactyla*, Perty, a species very near, if not the same as, our common northern mole-cricket, *G. borealis.* I cannot agree to the replacement of *Gryllotalpa* by *Curtilla*, a genus erected thirteen years later. *Gryllotalpa* was described by Latreille in 1802, the description being full and the *Gryllus gryllotalpa* of Linnæus cited as example. Thus I see no reason for discarding the name. Mr. Kirby lists the macropterous form of *borealis*, the *G. colubia* of Scudder, as a distinct species, with *G. longipennis*, Scudd., a synonym. *G. ponderosa*, Bruner, is also listed as distinct. It is very surely the same as *major*, Sauss. Kirby does not appear to possess specimens of either of these species.

Scapteriscus, Scudd.—The catalogue gives no records of any species of this genus from the United States, though they have been known from our fauna for some years. Both *S. didactylus* and *abbreviatus* are not at all rare in our southern States, especially the former.

Tridactylus, Oliv.—*Fissipes* and *incertus* have been shown synonymous with *terminalis*, *Illinoiensis*, *tibialis* and *mixtus* with *apicalis*, and *histrio* with *minutus*, but Mr. Kirby has listed them all as distinct species, placing the last two and *minuta*, also the South American *denticulatus*, in the genus *Ellipes*, Scudd.

Myrmecophila, Latr.—*Nebrascensis* should be accredited to Lugger, as he was the first one to give the name validity. Bruner gave no description of it, nor did Lugger, but the latter gave figures of it. Scudder was the first to give a description of it, but Lugger's figures established the name.

Liphoplus, Sauss.—This is sunk in synonymy under *Ornebius*, Guér, and the name is not found in the index. It occurs on page 57.

Nemobius, Serv.—Varieties *amplus* and *brevis* of *canus*, Scudd., which were described with the species, are not mentioned in the Catalogue. *Abortivus*, Caud., is given specific rank. *Affinis*, Beutenm., is not listed so far as I can find. *Exiguus*, Blatch., is replaced by *janus*, new name, on grounds of preoccupation. *Nemobius pictus*, Scudd., belongs to the genus *Miogryllus*, and is a synonym of *M. siccarius*, Scudd.

On page 19 Mr. Kirby has included a species under the name *Nemobius exiguus*, Say, with the reference Proc. Acad. Nat. Sc. Philad., iv, p. 309 (1825). The same reference, except that it is properly called Journal instead of Proceedings, is given on page 86 as the original

reference to the insect now known as *Anaxiphus exiguus*. The latter insect is the one described by Say, and Kirby's reference on page 19 should be quoted in synonymy under it.

Gryllus, Linn.--*Nigra*, Harr., is listed as a distinct species, is spelled *niger*, and has *neglectus*, Scudd., and *nigerrimus*, Walk., as synonyms. I should retain the original spelling, and place it as a variety of *Pennsylvanicus*, Burm. *Luctuosus*, Serv., is listed as distinct. I believe it to be a macropterous form of *abbreviatus*, Serv. *Americanus*, Blatch., listed as distinct, is a synonym of *Pennsylvanicus*, var. *nigra*, Harr.§ *Lineaticeps*, Stal, here listed as distinct, had probably better have been left in the synonymy under *assimilis*. *Acheta marginata*, Thomas, Trans. Ill. Agric. Soc., v, p. 443 (1865), is not mentioned in the Catalogue so far as I can find. It is not a member of the genus *Gryllus*.

Cyrtoxipha, Brunn.—*Gundlachi*, Sauss., occurs in the United States as far north as the District of Columbia. *Variegatus*, Bruner, Publ. Nebr. Acad. Sc., iii, p. 32 (1893), is sufficiently well characterized to warrant recording, but I can find no reference to it in the Catalogue. It is a synonym of *Nemobius carolinus*.

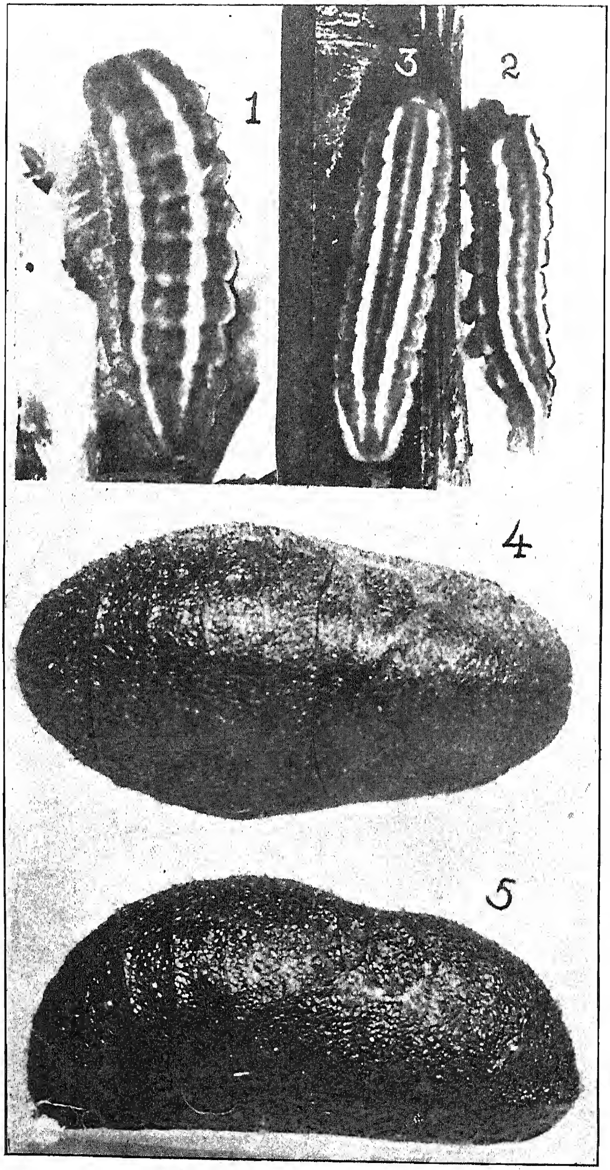
Orocharis Uhler.—*Uhleri*, McNeill, is a synonym of *Hapithus agitator*, Uhl.

Tafalisca, Walk.—*T. lurida*, Walk., should have the United States included in its habitat, as it has been recorded from our fauna, and specimens from Florida are in the collection of the National Museum.

A few species, such as *Conocephalus Caudellianus*, Davis, apparently described in time for recording, do not appear in the Catalogue. These will doubtless appear in the Supplement promised in the introduction to volume first.

§Blatchley's name could not stand in any case, being preoccupied by *Gryllus Americanus*, Drury, Ill. Nat. Hist., i, p. 121, pl. 49, fig. 2 (1837). That this first-established name applies at the present time to an insect of a different family, does not prohibit its preoccupying a later name of the same combination and spelling.

Mailed August 8th, 1907.



INCISALIA NIPHON.—LARVA AND CHRYSALIS.

The Canadian Entomologist.

VOL. XXXIX. LONDON, SEPTEMBER, 1907. No. 9.

STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

IV.—INCISALIA NIPHON.

(Continued from page 260.)

First Larval Instar.—The caterpillar just from its egg-shell has been carefully described by others, except under the microscope it appears to differ from newborn larvæ of *irus*, *augustus* and *Henrici* only in its slightly greater size and the darker colour. The differentiating character which I gave in a previous installment* has not borne the test of subsequent investigation. The statement there made, that in *niphon* the short bristles associated with the latero-dorsal series of hairs are black and comparatively conspicuous, was based on comparisons of the one living *niphon*, which I secured from an egg in 1906 with living and alcoholic material of the other species, and as the examination was made under the same microscope, with the compared caterpillars side by side on the same slide, it is hardly likely that I was guilty of an error of observation. However, the larvæ which hatched from eggs secured this spring (1907) were compared with living larvæ of *irus* and *augustus* in the same manner, and the notes taken read: "Latero-dorsal bristles not more conspicuous than in the other species, colour darker, rather anomalous, to naked eye and under a simple lens gray-green-yellow, as though the interior of the body were gray-green and showed through a transparent-yellow; with two-thirds objective the griseous appearance is lost, but the yellow is not so brilliant as that of the compared species. Otherwise as before noted.† No variation among 14 examined. Eggs from confined females, Lakewood, N. J., May 19th, 1907.

On the second or third day after birth the appearance of the larva begins to alter; the dorsal area shows two dull longitudinal stripes, and

*CANADIAN ENTOMOLOGIST, Vol. XXXVIII, No. 6 (June, 1906), p. 182.

†A complete set of newborn larvæ has been preserved, and a full discussion of the specific characters, with illustratious, will, it is hoped, be given in a second series of studies in the genus, dealing with the comparative anatomy of the various stages to follow these outlines of the life-histories.

the sides grow darker. For a time the colours are nondescript, but before the first skin is cast they have become definite and the design is declared. Dorsum rich brown, threaded by a faint lighter medio-dorsal line; on either side a moderately broad creamy-white stripe, extending from the second thoracic to the eighth abdominal segment, of about equal width to the fifth abdominal segment, tapering gradually and approaching each other posteriorly. These stripes include the latero-dorsal hairs, and are not interrupted by the incisures. Lateral areas brown, limited below by a narrower cream-coloured line along the top of the substigmatal fold, beginning at the second thoracic and continuous around the last abdominal segment. Ventral surface light green. Length awaiting first moult, 2.65 mm.; breadth at fourth abdominal segment, 1.01 mm. Duration of first stage five to seven days.

Second Stage.—At first not differing from preceding. After a day or two a change is observable in the shape of the larva, the segments which since birth have been nearly rounded above (the foveæ represented only as slight indentations) assume the complex fold, common in varying degrees to all Lycænid larvæ. A little later a very faint, lighter brown spiracular line appears, extending from the third thoracic to the sixth abdominal segment, and interrupted by the incisures. Underneath the substigmatal fold the green is of a lighter tint at the base of each proleg. Length at rest for second moult, 6.1 mm. Duration of this stage six to eight days.

Third Stage.—No noticeable change, except in size, for several days. (Plate 9, fig 1, larva × 8.) Then the brown, which up to this time has been of the same shade in all the larvæ, begins to show some slight variations. Some individuals grow paler, the brown showing traces of yellow, others become darker, and in one case the brown assumed for about 24 hours a decidedly reddish cast. These alterations in the colour are preliminary to a much more striking change, and due probably to the decomposition of a pigment, which at this period in the life of the caterpillar is no longer of any use. At any rate, the brown weakens just as though a pigment were being removed by metabolic processes, and in a surprisingly short time it has quite disappeared, leaving the areas, which were formerly brown, deep pine-needle-green. Concomitantly the creamy stripes become pure white, and the medio-dorsal and spiracular markings grow larger and better defined. Length when up for third moult, 9 mm. Duration of the stage five to seven days.

Fourth Stage.—During this instar the segments again fill out, reducing the folds and foveæ considerably, though they can still be made

out. There is no change in the colour or pattern, except that the medio-dorsal line becomes somewhat more prominent, and the spiracular line appears to cross the incisures. Length a day or two after the fourth moult, 14 mm.

Final Stage.—(Plate 9, figs. 2 and 3, mature larva × 3.) Not differing from preceding stage, the general effect of the stripes being a striking example of protective coloration, alternate lines of white and pale green on a dark green background being well calculated to render the larva inconspicuous as it rests among the clustered pine-needles. During the last two instars the latero-dorsal white stripes become tinged with yellow, which may deepen to a decided orange. Unlike the congeneric caterpillars, the markings do not disappear as the time for pupation approaches. Length when feeding has stopped, 17 to 20 mm. Duration of fourth and fifth stages together; 10 to 18 days, at least two days being spent upon the final mat.

Length of Larval Life.—The shortest span from egg to chrysalis was 27 days 10 hours; the longest, 38 days; the average for 12 larvæ, 30 days.

Pupation.—The caterpillars seek the ground as the time for pupation approaches, and turn to chrysalids among the leaves.

The Chrysalis.—(Plate 9, fig. 4, dorsal aspect; fig. 5, lateral aspect × 8.) I am unable to find any character which will serve to distinguish the chrysalis of *niphon* from that of *irus* or *augustus*. As a rule, it is very dark above, the wing-cases somewhat ruddier, the whole surface heavily sprinkled with black spots and irregular blotches, variable in size and arrangement, and affording no clue to the species of the enclosed insect. The "slender dorsal ridge" is a variable quantity sometimes present, but more often not.

TENTHREDINIDÆ OF COLORADO.

BY GEO. P. WELDON, COLLEGE PARK, MD.

Unlike most families of the Hymenoptera, the Tenthredinidæ are not highly specialized insects. They do not live in well-organized societies as do many of the bees, ants and wasps, but are solitary in their habits. In the case of the social Hymenoptera, we have a colony organization where different kinds of individuals are entrusted with different duties to perform. Such a high degree of specialization is manifest, that we observe with amazement and wonder the instinctive qualities displayed by them. Not so in the case of the Saw-flies: the only obligation resting upon these

little insects for the assurance of the perpetuation of the species, is in the deposition of the eggs upon some food-plant, where nature attends to the hatching, and the larvæ, guided by what we call instinct, look out for themselves.

The name Saw-flies was given to the Tenthredinidæ because of the shape of the ovipositor of the female, which resembles two minute saws placed side by side, and fitting into a groove underneath the abdomen, similar to the manner in which the blades of a knife fit into the handle. Not only do these weapons resemble a saw in shape, but they also serve the purpose of a saw, for the larvæ feed upon living vegetable tissue, the saws being used in making an incision for the reception of the egg.

In general, the Hymenoptera is a beneficial order of insects, but in it are also some pests of special economic importance, because of their destructive habits. Such pests belong to the Saw-fly family.

Though a few pests among them occur in Colorado, a far greater number are harmless, and never noticed in the adult stage, save by the entomologist or some other close observer of insect life. The genus Tenthredo contains the greatest number of Colorado species, none of which are of any special economic importance, but none the less interesting to the student of entomology.

Many species of Saw-flies have the gall-making habit, these galls being found on different species of willow, and are familiar objects to any one who has spent much time along the mountain streams of Colorado, where many species of willows grow in abundance, and are often very much disfigured by the presence of the little miniature houses of these gall-inhabiting species.

A special study was made of *Euura S. nodus*, a common species in Colorado, inhabiting galls occurring on Salix longifolia, and described by Mr. Benjamin D. Walsh as gall S. nodus. The following is his description of the gall, and is accurate for the Colorado specimens :

" *Gall S. nodus*, n. sp., on Salix longifolia. A mere gradual enlargement of a twig from one-fourth more than its normal diameter up to twice its normal diameter, almost always without any abnormal roughness on the external bark, and always not confined to one side of the twig. General colour that of the twig. When cut into August the 28th, the interior of each gall is found to be pithy, and to contain one to three larvæ in separate cells. Frequently on a piece of twig six inches long three or four of these galls are placed at irregular intervals. No appearance internally

of any transverse plates or fibres as in S. ovum and S. ovulum. Length, .75 to 1.5 inch; diameter, .10 to .25 inch. Very like the Cecidomyidous gall S. nodulus on the same willow (Proceedings of the Phila. Ent. Soc., Vol. 3, page 600), but is much larger, is polythalamous instead of monothalamous, and occurs near Rock Island, Ill., in quite a different locality. Analogous willow galls are made in Europe, not by a Euura, but by several small species of Nematus. (Westw. Introd. 2, p. 105.)"

Gall S. nodus is very common on Salix longifolia along the streams of northern Colorado. Mr. Walsh was familiar with the male of this insect, but knew nothing about the female. His description of the former is given in a comparative way with reference to Euura S. ovum. In my work with Euura S. nodus, a study was made of the winter and spring stages.

On the 6th of Jan , '06, a large number of galls were collected along the Big Thompson Creek, in the vicinity of Loveland. These galls were placed in breeding cages and kept in the laboratory of the Entomological Dept. of the Colo. Ag. College. A large number of galls were opened at this time, most of which contained larvæ, each one enclosed in a delicate cocoon, and from one to three in each gall, but usually not more than one. Both living and dead galls contained perfectly healthy larvæ. The first adult emerged on the 22nd of February. They then continued to emerge until the 6th of March, when the last of the lot made its appearance.

After the emergence of the first adult, a number of galls were cut open and examined for pupæ. This stage of the insect was not studied by Mr. Walsh, or not known by him at the time of his description of the adult. As found in the galls, their length varied from .25 to .30 of an inch.

Many more galls were collected and examined on the 4th of March. All galls which contained insects of the Tenthredinidæ family at all, contained them in the larval stage, showing that the unnatural conditions existing in the laboratory caused an early transformation from larvæ to adult of the previous lot. The first adult emerged from these galls on April 4th. There also emerged on this date a small Chalcid parasite.

On the 26th of March a great many galls were collected along the Poudre Creek, just on the outskirts of the City of Fort. Collins. On the 13th of April a couple of Ichneumon-fly parasites were found in the breeding cage, and on the 24th a large number of Euura began to emerge.

From all galls collected there were about an equal number of males and females which emerged. On May 1st I examined a large number of galls along the Poudre, and found at this time most of the flies had pupated; some few had already escaped, a few were still larvæ, and in one case an adult female was found in the gall, having just completed its transformation to the adult stage, and was ready to emerge.

It is interesting to note how the adult fly escapes from the gall, or rather how it makes provision for its escape. If galls are examined during the winter months many of them will be seen to contain a small round smooth hole, usually near one end. If these galls are opened, the larvæ will be found at the end of a burrow leading to this opening, but securely sealed from the outside by a plug, made from bits of wood chewed off by the larvæ in the process of making the hole. It is a wonderful instinct that guides these larvæ in making this hole, which the adult could not possibly make itself, and were not means for its escape from the cell prearranged by the larvæ, death would be the inevitable result.

While examining galls I noticed that there were many that did not have this hole by means of which the adult could escape, so proceeded to determine the cause for this condition of affairs. A large number of these galls were cut open, and not in a single case was a Euura larva found within. There was, however, in nearly all of these the larva of a little hymenopterous parasite belonging to the Chalcididæ family. A number of these galls were placed in a breeding cage by themselves, where the little parasites soon emerged. The only explanation that I could give for this condition was: That this parasite had worked upon the Euura in the fall of the year, before the former had attained its growth and provided means for its escape as an adult the following spring by gnawing the usual hole in side of gall. The parasitized larva, being unable to withstand the attack of its little enemy, perished, whereas the destroyer lived in the gall in comfort throughout the winter months, and after completing its transformations in the spring escaped by means of a small hole made with its tiny strong mandibles. These little escape holes were plainly seen, freshly gnawed in many of the galls from which the little parasites were emerging.

Two Cecydomiid flies were also found in this breeding cage, but came from different galls, much resembling the others, but monothalamous instead of polythalamous.

Owing to the fact that Mr. Walsh's description of Euura S. nodus is given in a comparative way with reference to Euura S. ovum, a description of the latter is inserted here before the description of the former.

Imago.—*Euura S. ovum*, n. sp.—Shining honey-yellow. Head, with the eyes, a square spot enclosing the ocelli, but separated from the eyes by a pretty wide orbit, and also the tips of the mandibles, all black. Clypeus emarginate, in a circular arc of about 90 degrees. Labrum rounded at the tip. Occiput more or less clouded with black on the disk. Antennæ dull rufous above, with their basal one-half black, honey-yellow below, with the scape black, and more or less of the basal half of the flagellum dusky, three-fifths as long as the body, joints three to five subequal, four slightly the longest, five to eight very gradually becoming shorter, nine fully as long as eight. Thorax with an oblong spot on the anterior lobe of the mesonotum, generally extending from the collar two-thirds of the way to the hind angle of the lobe, rarely covering almost its entire surface; anterior disk of the mesonotum, and the edges of the basal plates that border on the basal membrane, or rarely the entire surface of the basal plate, all black. Cenchri whitish. A more or less black cloud on the pectus, and another on the posterior disk of the pleura, the former occasionally obsolete. Abdomen with that part of the anterior edge of joint one that borders the whitish basal membrane, or rarely the basal one half of joint one, black. Ovipositor honey-yellow, the tarsal claws dusky. Wings hyaline, veins black; those on the costa, as well as the basal one-half of the stigma, whitish or yellowish, the rest of the stigma dusky. Length of female .17 to .22 inch. Front wing of female .18 to .24 inch.

Euura S. ovum male differs from the normal female only as follows: First, the ground colour is greenish-white, not honey-yellow; second, the black spot enclosing the ocelli is larger, and is separated from the eyes only by a narrow orbit, and occasionally touches them for a small space; third, the occiput, except the orbit, is distinctly black; fourth, in the antennæ the pale colours are more dominant, and verge more or less on greenish-white, and the antennæ are three-fourths, not three-fifths, as long as the body; fifth, the thorax is black, except the tegulæ, the superior margin of the collar, and the cenchri, which are all greenish-white; sixth, the abdomen is black above, greenish-white below, the lateral plates basally black, but terminally clouded with the pale colour. Basal membrane white. Seventh, the legs are greenish-white, sometimes, especially

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the hind legs, more or less honey-yellow. In the hind legs, the base of the coxæ, the extreme tips of the femora and the tarsi are more or less fuscous. Eighth, the veins on the costa are scarcely whitish, and only the extreme base of the stigma is whitish. Length of male .10 to .17 inch.

Description of Euura S. nodus as compared with Euura S. ovum (Walsh). "Imago.—*Euura S. nodus*, n. sp.—Male differs from male of *Euura S. ovum* as follows: First, the pale colour is bright honey-yellow, not greenish-white throughout; that is, both in antennæ, body and legs. Second, the black spot enclosing the ocelli is larger, and confluent with the eye for its entire length, leaving no orbit between them. Third, the venter dried is honey-yellow on the terminal three or four joints, and in the middle only of one or two more. Basal plates black, as in Euura S. gemma. When recent, the venter was noticed as being greenish, and the legs are pale fulvous. Fourth, the legs dried are honey-yellow, immaculate, except the extreme tarsal tips. Fifth, the basal one-half of the stigma is whitish, as in Euura S. ovum, female. Length, male .16 to .17 inch; front wing of male .17 to .18 inch. Two males, female unknown."

The following is a description of the females which I have reared in large numbers from the galls:

Euura S. nodus, female.—Shining honey-yellow. Length, .22 to .25 in. Head: Black spot enclosing the ocelli usually small, and not confluent with the eyes, palpi and tips of mandibles black, otherwise yellow. Antennæ: Last four joints of a more or less rufous tinge; basal joints black, 3rd, 4th and 5th joints subequal, very gradually shorter to tip, ninth joint probably a trifle longer than eighth. Thorax with an oblong spot extending from the collar two-thirds of the way to the hind angle of lobe of the mesonotum. Metathorax, also sometimes pleura and pectus, black. There is a great variation here, and sometimes pleura and pectus are entirely yellow. Basal plates black. Abdomen yellow, with the exception of the sheath of the ovipositor, and part of the first segment, which are black. Legs honey-yellow, with tarsal claws blackish. Wings hyaline, veins black except costal margin vein and base of stigma, which are whitish.

The general appearance of Euura S. nodus and Euura S. ovum are the same. The latter is, however, much smaller, and the females of a darker colour.

Quite a number of Euura S. ovum galls were collected, but only a very few brought to maturity any of the Saw-flies. In fact, very few of

them contained larvæ at all, as they had been previously parasitized, consequently we were unable to make much of a study of this species, though their galls were quite common in certain localities.

In the study of Euura S. nodus we were unable to make a study of the egg stage. Eggs are, however, undoubtedly laid by the adult female about the time that the willows are leafing out in the spring. They are deposited in a slit made in the bark by means of the little saw-like ovipositor. As a result of the deposition of this egg within the twig, the characteristic gall is formed where the larvæ live throughout the winter months, pupating in the spring. The adults make their escape by means of the hole gnawed in gall by the larvæ before they ceased feeding for the winter. This, in general, is the life-history of the species.

The following list of species occurring in some of the more important genera of Colorado, though far from being complete, we trust will aid in the further study of this interesting family.

The references given do not in every case refer back to the publication in which the original description occurred, but wherever possible reference is made to some work commonly found in ordinary libraries.

The material at my disposal was that owned by the Entomological Dept. of the Colo. Ag. College. Those specimens which were seen and studied by me throughout the time of these investigations are marked with a star; other species did not occur in the collection, but are reported as occurring in the State by other writers on the Tenthredinidæ.

Thanks are due Prof. Alex D. MacGillivray, of Cornell University, for helping in the determination of some of the material, also to Prof. C. P. Gillette, of the Colo. Ag. College, who kindly tendered the use of his collection and library, and under whose direction the work was carried out.

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*Euura minuata, MacGillivray.

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*Blennocampa Gillettei, n. sp.

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*Tenthredo xanthus, Nor., Proc. Ent. Soc. Phila., Vol. 3, p. 13.
*Pœcilosoma punctulata, n. sp.

Descriptions of New Species.

Pœcilosoma punctulata.—Colour black. Length .25 inch. Head narrow from back to front. Eyes set well apart. Abdomen long and extremely flat. In the type specimen it is somewhat concave on the dorsal surface. The base of each segment of the abdomen, except the last two, contains two dorsal white spots, one on each side of the surface, extending nearly half way to the joint in front, and close to the centre of the body. Wings are hyaline, with a beautiful violaceous tinge. Stigma and nervures black.

Emphytus coloradensis.—Colour black. Small species, being only .18 inch in length. Tips of mandibles red, and palpi white. Tibia of front legs, tip of femora, and first joint of tarsus, white, rest of fore legs black. Middle pair of legs have the tibia and femora partly white. Hind legs entirely black. Wings hyaline, nervures black. Lower two-thirds of stigma a lighter colour than upper third.

Blennocampa Gillettei.—Colour black. Length of body .18 inch, to tip of wings .25 inch. Head rounded. Tegulæ white. Body short, contracted. All the legs agree in having the tip of femora and tibiæ whitish, with the tarsi slightly darker in colour. Wings extend well beyond the tip of the abdomen. Slightly dusky, with beautiful violaceous tinge. Nervures black. Stigma wide, lower two-thirds of lighter colour than upper one-third.

DESCRIPTIONS OF NEW SPECIES OF CECIDOMYIDÆ.

BY WILLIAM BEUTENMULLER, NEW YORK.

Asphondylia solidaginis, sp. nov.—Male and female. Eyes black. Face and posterior portion of the head sordid-orange, with a few long black hairs. Neck orange. Thorax above slaty-brown, with short whitish hairs in the two longitudinal grooves, and with rather long brownish hairs along the sides. Scutellum slaty-brown. Sides of thorax dull orange, marked with black. Abdomen dull slaty-brown, sparsely covered with short appressed whitish hairs; junctions of segments dull orange; under side wholly dull orange with whitish hairs. Legs of female black, femora whitish basally, junctions of femora and tibiæ narrowly white: first joint of tarsi pinkish-white. Legs of male paler than in the female, somewhat pinkish in certain lights, and with the white band on the junction of the femora and tibiæ less distinct. Wings densely covered with blackish scales. Halteres dull orange, with brownish-black scales. Length of male, 2.50 to 2.75 mm.; of female, 2.50 to 3 mm. Expanse of male, 4.50 mm.; of female, 6 mm.

Gall.—Monothalamous. Pale green, rounded somewhat, blister-like, much broader than high, single, or two or three in a row coalescing. Inside it is white, and contains a large larval chamber. It is formed between two, three or four leaves fastened together, the gall protruding on the upper and under side of the leaves. Width, 2.50 to 3.50 mm.; height, 2 mm.

Habitat.—Fort Lee, New Jersey; Staten Island and Bronx Park, New York City; Valley of the Black Mts., North Carolina (W. B.); Ithaca, New York (J. G. Needham).

Very common in certain localities.

The gall is evidently formed in the young buds of the plant when the immature leaves are galled by the larva, and remain fastened together as the leaves develop and become mature. The gall becomes mature late in June and early in July. The larvæ transform in the galls, and the flies emerge early in July. The gall is found on the Golden-rod (*Solidago serotina*), and it seems to be confined to this species of plant.

Cecidomyia lysimachiæ, sp. nov.—Male and female. Eyes black; face and posterior portion of the head white. Antennæ brown. Thorax

deep brown above, with golden-brown hairs along the middle and at the sides to the base of the wings. Thorax at the sides and beneath semi-translucent, red. Scutellum red. Abdomen blood-red, with a very broad, brown band on each segment; sides and beneath blood-red, with a few pale scales. Wings blackish-hyaline. Legs fuscous above, pale brown beneath. Halteres reddish. Expanse, 3 mm.

Gall.—Bud-like, and composed of immature leaves drawn together. It is formed at the extreme summit of the plant.

Habitat.—Fort Lee, New Jersey; Bronx Park, New York City.

The eggs are deposited in the young buds of the Loosestrife *(Lysimachia quadrifolia)*, causing them to remain aborted and fastened together. The flies emerge late in June. After the flies have emerged, the deformed leaves of the galled buds begin to expand.

Cecidomyia myricæ, sp. nov.—Male and female. Eyes dark brown; front semi-translucent, sordid white. Antennæ as long as the body, fuscous; first and second joints semi-translucent, white. Thorax dull brown, smooth, with two yellowish longitudinal lines on the dorsum; posterior portion and scutellum dull amber-yellow, sides of thorax dull amber-yellow marked with brown. Abdomen dull amber-yellow above and below, sparsely beset with brown hairs. Legs fuscous. Wings hyaline, with black scales. Halteres semi-translucent, yellowish. Length, .75 to 1 mm.

Habitat.—Carlstadt, New Jersey.

Bred Aug. 2nd to 5th from bud-galls on *Myrica cerifera.* The larvæ live in numbers in the buds of this plant, causing them to become deformed. The larvæ pupate in the ground.

Cecidomyia meibomiifoliæ, sp. nov.—Male and female. Eyes black. Thorax and abdomen pale orange, the latter somewhat darker dorsally. Antennæ and legs fuscous. Wings blackish, hyaline. Length, 1.25 to 1.50 mm.

Habitat.—Carlstadt, New Jersey.

The larvæ live in the buds of *Meibomia Canadense*, causing an arrest of growth of the leaves. Collected July 11th. Adults emerged July 20th to 25th. Larvæ pupate in the ground.

Cecidomyia verbenæ, sp. nov.—Male and female. Head and thorax pale semi-translucent, yellow. Eyes black. Antennæ fuscous, whitish at

the junctions of the segments, with long brown hairs in the male, simple in the female. Abdomen pale semi-translucent, orange or yellow; posterior portions of the segments with rather long concolorous hairs directed backward. Legs pale yellow. Wings yellowish, hyaline. Length, 1 to 1.25 mm.

Habitat.—Bronx Park, New York City; Fort Lee, New Jersey.

The larvæ of this species live in numbers between the unexpanded young leaves of the common white or Nettle-leaved Vervain (*Verbena urticifolia*), causing them to become deformed and twisted. Collected July 8th to 10th. The flies emerged from July 15th to 25th. The larvæ transform in the ground.

DISASTROUS FIRE AT NEWARK, N. J.

The headquarters of the Newark Entomological Society, on the fourth floor of the Newark Turn Hall, were completely destroyed by fire in the early morning of June 3rd, 1907. The conflagration demolished not only the entire building, but also resulted in the loss of three lives.

The property of the Society consisted of a forty-drawer cabinet, containing 1,000 specimens of Lepidoptera and 2,500 specimens of Coleoptera, mostly representing local forms, besides a small collection in other orders; also a book-case with 110 bound volumes and 365 unbound volumes and pamphlets. All of this property was consumed by the flames, except a few books that were in the hands of members. This collection of publications and insects was the accumulation of over 20 years of the Society's existence, and as the loss was only partially covered by insurance it will be a long time before it can be replaced. Some of the books, perhaps, can never be obtained again.

The Society will be exceedingly grateful for any help in the way of restoring the library that may be given it. Entomologists are earnestly invited to send separates of their papers or other publications that they may have in duplicate, for which the cost of transmission will be gladly refunded. Until the Society is again established in permanent quarters, parcels should be addressed to the secretary at New Brunswick, New Jersey.

JOHN A. GROSSBECK, Secretary.

TWO NEW SPECIES OF TENTHREDINOIDEA.

BY ALEX. D. MACGILLIVRAY, ITHACA, N. Y.

The following descriptions are offered so as to make it possible to refer to the species by name in descriptive papers.

Pamphilius persicum, n. sp.—Female. — Body black, with the following parts yellow: the labrum and clypeus broadly, the posterior orbits, the front orbits with a band extending to the occiput, with two tooth-like projections on the mesal side near the eye, a pair of lunate marks behind the ocelli, a small spot on the hypoclypeal area, the palpi, the V-spot, the tegulæ and base of the wings, the scutellum, the post-scutellum, a small irregular spot on the pleura, and the legs, except the extreme bases of the coxæ, becoming rufous beyond the middle of the tibiæ; mandibles and abdomen rufous; antennæ with thirty segments, the third and fourth subequal in length. Length, 10 mm.

Habitat.--Yalesville, Connecticut. Collected by Mr. B. H. Walden, on peach, 14th June, 1906.

Hylotoma spiculata, n. sp.—Female.—Rufous, with the following parts black: apical half of the mandibles, apical half of the suture extending from the antennæ to the mandibles, a minute spot above the base of the antennæ, the apical third of the antennæ, the prothorax, except the apex of the pronotum, the middle of the median lobe, a spot on the lateral lobes at the base of the wings, the metathorax, the pectus, the sides of the basal plates, a broad band on the sides of the five basal abdominal segments, with a narrow line extending along the posterior dorsal and the posterior ventral margins of the segments, the ventral half of the saw-guides, the coxæ, the trochanters, the apical half of the femora, a broad band on the front wings from the medio-cubital cross-vein to the apex of the wing, except the stigma and a narrow area beneath it; a triangular spot in the third median cell, a spot covering the cubital and anal area, and the apex of the hind wings; the tentorial invagination of the front distinct, two and one-half times as long as broad; posterior tibiæ with a single middle spur; claws simple; antennæ, apex of the abdomen, apex of the legs, and wings yellowish. Length, 13 mm,

Male.—Entirely bluish-black, except the anal and cubital areas of the front wings and the basal half of the hind wings. Length, 12 mm.

Habitat.—Oak Creek Canon, New Mexico, 6,000 ft., August; F. H. Snow, collector.

September, 1907

NEW HISTORIES AND SPECIES IN PAPAIPEMA (HYDRŒCIA).

BY HENRY BIRD, RYE, N. Y.

(Continued from page 276.)

Few will appreciate better than the author that the working out of life-histories in this genus is a greater contribution to entomological knowledge than the mere description of new forms. One gets quite a different idea as to what is truly representative from breeding the various species than from the random imago that is occasionally captured. These moths are unusually secretive, their flight and life being very short normally, so that their appearance in cabinets is rare compared to their number in nature. For example, *cerussata* is commoner, locally, than *nitela*, yet the former appears in a short interval, while the latter's emergence is for a lengthy, protracted period, and it is on the wing during the whole of September and October. So one will take at light fifty of *nitela* to one *cerussata* per season. With species having a concentrated appearance there is good evidence that a female never spreads her wings unfertilized, and it is known that their life after oviposition, which consumes three or four days at most, is hardly longer. It is a fact, too, with many specimens in collections which were taken in flight, that we find them undersized and ill-marked, being examples whose emergence was protracted past the normal date, or whose larvæ left their original burrows and completed their transformation in a more or less starved condition, and they little show what the species really should be like. A good illustration occurs with *eupatorii*, the few undersized specimens which happened to be in collections were identified as *nelita.* So soon as the former is bred and a representative specimen comes to hand, no one for a moment would assign it to any previously-described form. And even with *nelita*, it has remained for breeding to definitely settle its identification.

These arguments are advanced to show cause for still another name, indicative of a species very widely distributed and which has been under observation in its early stages for seven years, and which finds in *Pteris aquilina* a plant commensurate to all its desires. So close, however, does it come to *Harrisii* as larva, and to *purpurifascia* as imago, with a balance of suggestion pointing to the former species, that to raise it to specific rank appeared superfluous. Yet efforts to prove it a variety fail, and the evidence in the field offers not the remotest clue to that end. The slight discrepancy from *Harrisii* seemed easily attributable to the difference in food-plant, and the question was closely studied. The latter

chooses *Heracleum lanatum*, which is pungent, juicy and of rank growth, quite as opposite to the dry, stringy fern-stem as one could well imagine. *Heracleum* grows in great perennial clusters in many places at Rye, some having been undisturbed for a quarter of a century and never burned over. Even with such ideal conditions, and in a search that has gone on regularly for twelve years to detect the borings of *Harrisii*, there has never once appeared a *Papaipema* larva working in it, nor has this species occurred from any other local source. In practically the same locations *Pteris* grows abundantly, each year tenanted by goodly colonies of its particular form. Evidently, at the present time there is no change of food-plant. So the experiment of introducing the fern-borers at various stages to a *Heracleum* diet, which is easy in its hollow stalk, was repeatedly made, and always with negative results. Cross-breeding was not attempted for lack of material, and such artificial resorts hardly confirm natural conditions. While this diagnosis of appetite is not to be considered of value specifically, there are features in the generalized larva which point to this form being the stem of the various yellow species, certainly its taste for a Cryptogam might have been brought down from those remote ages of the past, that are clothed in the Cenozoic haze we would so gladly pierce. Finding ourselves, then, in contact with this representative form, whose history and anatomy must have an important bearing in a study of the phylogeny of the genus, we ask to be allowed to introduce still another aristocrat.

Papaipema pterisii, n. sp.—Form and habits typical; ground colour yellow. Primaries show the usual markings and contrasts. T. p. line bends but little, its geminate form hardly discernible, the outside one a purple fascia, though in many specimens it might not be regarded as such. Reniform broken, partly concolorous, only the two inner sections white-marked. The orbicular and claviform offer the best superficial character, the latter is not divided; orbicular irregularly quadrate, and its attachment to the upper part of claviform produces a conspicuous, brightly-white blotch or bar, longer than the reniform. Secondaries lighter, clouded at the margin. The discal spot is not noticed from above. The male structures are fitly representative of the typical form. They differ from ***verona***, though not perceptibly from *Harrisii* or *purpurifascia*. Expanse, 31–32 mm.; 1.25 in. Three specimens furnished the description. A co-type will be placed in the National Museum.

The species is less highly coloured than *purpurifascia*, from which its larva separates it, and the slight differences in moth and larva remove it sufficiently from the other ally.

May 25th to 28th find the young larvæ hatching from the hibernated eggs. They enter the stem a few inches above the ground, and work down to the natural enlargement of the stalk that occurs in all plants, whether infested or not, just below the ground-level. At the same date the plant is attacked above by a Micro, in the petiole of the unrolling frond. Both often choose the same plant, though their combined efforts produce little retardation. A very limited gallery is made by *pterisii*, for the plant is inadequate for extended mining, the larva eats less, and is the most lethargic of any known. To the fourth moult the larva shows no individuality, except that it belongs to the group having the white dorsal line alone continuous and unbroken. Stage V: Colour dull wine-red, lines white, dorsal continuous. No accessory tubercle IV*a*, the true IV low down in the generalized Noctuid position. All tubercles small and ill-defined. Head wider than shield. Stage VI: Head 2.1 mm. wide, still narrower than shield, and shield small. Colour is much faded. Tubercles same as before, neither IV nor V on joint ten bear setæ. Stage VII: Head 2.4 mm. wide, normal. All lines and colours lost in a soiled translucence. The larva now typifies a primitive, generalized form of that section which has in its early stages the continuous dorsal line, not acquiring any special accessory and protecting tubercle plate at the spiracle on joint ten. Of its allies, *purpurifascia* has acquired a large plate here, and *Harrisii* a very minute one. All tubercles weak, though black marked; normal. Length, 37 mm. Pupation occurs in the last days of July, the plant being deserted, and the moths come forth August 21st to 31st.

Probably no other species suffers to quite such an extent from regular yearly parasitism. Though it is so common and is represented in most collections, the acquisition of a good series is no easy matter. The plant is obdurate for breed-cage experiments, and maturity in the field finds them stung, and doubly stung. So fierce is this struggle and so numerous are the persecutors that it seems natural selection could never play much importance in any unbroken line; nor is it seen how such mutants as might arise were able to perpetuate a new character. But even the last few centuries must have surrounded our Lepidoptera with greatly changed conditions, and we are little able to speculate conclusively.

Papaipema (Gortyna) eupatorii, Lyman.—This newly-described species was encountered in the larval state in the New Brighton section, establishing the fact, that, like most other species, it is widely disseminated. It is quite distinctive in both moth and larva, being easy of recognition, especially as the food-plant does not seem to be popular with many other species, and it is certainly one of the nice things recently exploited. The larva has the happy trait of pupating in the food-plant, thus offering an extended period for securing it. Were parasites less destructive it would be easiest to let them thus remain and simply gather the pupæ. But *Eupatorium* is an ungainly plant to transport, and if left to mature afield but a very small percentage remain unaffected, hence it is not so easy to get it in numbers as some other species. An exit aperture, similar to the work of *imperturbata*, is made, for the stem rarely falls so as to be broken off, and the larva is careful to plug the great hollow stalk with dried bits above, so the moth must use the door, and not make the mistake of crawling up the interior.

The following will sufficiently characterize the larva, which has not been described: Head 2 mm. wide, rather small for the stage and size of larva; yellow and shining, as is the shield. Mouth-parts and ocelli only are black. Body tapers both anteriorly and posteriorly slightly; colour pale dull sienna. Lines are wide, pale cream colour, indistinct for the stage, none seem to cross the first four abdominal segments. An earlier stage might prove the dorsal to be continuous, but there is so little contrast at present it cannot be made out. Tubercles are very weak and concolorous, though III and IV can be made out, except on joint ten, where III, directly above the spiracle, is a minute dot. On this joint IV is transparent and normal; there is no accessory IV*a* above it. Spiracles very small, the merest dots, but are black, as is usual. Anal plates small. Length, 35 mm.

Mature larva: As before, except that the shade is a creamy-white. The body is very perceptibly thickened centrally. No change in plates. A primitive larva that one would hardly think belonged to this genus at first glance. Length, 37 mm.

The pupal change occurs in the first days of August, and the pupa is more cylindrical and less tapering than its close allies. On the front is a very slight ridge, though this is not toothed as in *necopina*. One specimen only had the very faintest spur. The anal extremity is comparatively blunt. Moths emerge September 20th to 28th. The male structures

show some individuality compared with its allies. The harpes are less forked, obtusely rounded above, the outer margin nearly straight to the lower lobe, which is there sharply angled, but the usual slender, tooth-like projection does not occur.

Papaipema nelita, Strecker.—The exact standing and determination of this species had not been clear to the minds of all, especially the writer, so when the larva and early habit came to light there was much satisfaction experienced. After two seasons' acquaintance it is still of much interest, being very coy in the matter of supplying imagoes, a total of three for the two years is really the worst ever experienced. These poor returns were due to its maturing at an unexpectedly early date, and the enemies that prey are legion. Upon the first appearance of the moth it was identified as Strecker's species from the description, and later this was confirmed by an examination of his types. *Ærata*, described by Lyman as a new form in 1901, was soon afterward placed by its author as a synonym of this species. It can hardly be *nelita*, however, and is likely valid, certainly if the larva is as he mentions in the meagre note, stating that the usual longitudinal lines are all continuous. Only two other species possess this feature—*cataphracta* and *duovata*—and we know the larvæ of all other known mouse-gray species. As the food-plant he mentions is Burdock, his find was evidently a case of substitution, for the species is not taken commonly from that source, even in the type locality, and as this plant is very generally bored by *cataphracta* the question may be open to possible error.

Rudbeckia laciniata is the plant chosen by *nelita*, and judging by its numbers in Western Pennsylvania and the wide distribution of the plant, it must occur very generally through the Middle States, though perhaps not crossing the Alleghanies in such numbers, for it has not so far been detected in Westchester County, N. Y. Work is carried on at the foot of the large stems, getting below ground at maturity, and an oval swelling is produced, which strengthens the stem sufficiently to keep erect. The commodious cell thus formed is forsaken, however, for the pupal change, though why such snug quarters do not appeal to this species, when all the rest of the superficially-allied ones change in their burrows, is not apparent. Working in conjunction with *nelita* at the base of *Rudbeckia* is the larva of the recently-described *Hysterosia Birdana*, Busck, which shares in the imago the pretty purplish-brown colours of its partner. A more than usual affinity appears to exist between the two, the galls tenanted by *nelita*

very often have the walls mined by *Birdana*, and it may be that these swellings are more spongy and tender than the bases of unaffected plants. Pupation is reached by the latter before *nelita* larvæ are quite mature, and its appearance is correspondingly sooner. Busck's type was inadvertently labelled "bred from *Helianthus*," which is here corrected.

Nelita larvæ were found in the last two stages, and it proved to belong to the section possessing the continuous dorsal line. An inflate at maturity shows some individuality, and its description is as follows: Head normal and agreeing with allies; 2.4 mm. in width. Shield wider than head, though its length, dorsally, is less than usual. All tubercles defined with black plates, the usual discrepancy in the size of some is not apparent. For instance, I is comparable to IV in point of size on all abdominal segments, a feature which rarely happens; in fact, all are very similar, except III*a*, which is normally small, and lies very close to the spiracle at its upper anterior corner. The abdominal leg plates are equally evident and bear three setæ. On joint ten IV is normally placed low down, with no accessory plate above at the upper posterior side of the spiracle. The latter are black. The anal shield is comparatively small, the two dorsal plates preceding on this joint are not merged with it, or with each other. The body tapers at each extremity; its colour is white, all lines lost, the semi-translucence less livid than in many others. Length, 35 mm.

Maturity occurs July 15th to 20th, and the pupa is formed under a slight depth of soil or moss. It is a very ordinary, normal pupa, no development at the clypeal region, its colour darker and less shining than any species here described. Length, 17 mm. Dates of emergence, September 1st to 15th.

Papaipema frigida, Smith.—The description of the species *thalictri*, Lyman, and its so-called variety, *perobsoleta*, in this magazine for September, 1905, drew attention to the Meadow Rue as being a preferred food-plant in its case, where our own experience had only heretofore encountered *cataphracta* working in this plant. The western Pennsylvania fauna was found to be prolific of the species, and due search finally disclosed it in the home locality. In the series bred all are those having white-marked stigmata, and their resemblance to *cerussata* is striking for a species whose larvæ differ so obviously, and it is likely that flown examples of one could easily be mistaken for the other. This reflection leads to another, presenting a question that dates back to the Revision of

Hydrœcia in 1899, by Prof. J. B. Smith. At that time material was comparatively scarce and the larval histories mostly unknown, but it has been a matter of satisfaction that subsequent breeding and larval studies have been confirmatory of the new features there advanced. There was, however, one question, one oversight apparently that never could be fathomed.

Illustrations in the Revision were of male structures only, and one, fig. 25, on plate II, presumed to represent *cerussata*, was found to be in error. *Cerussata* had later become plentiful through the discovery of its larvæ, and the genitalia were duly examined to note the "break" occurring with it, as chronicled in that publication. But it was found to be entirely typical, well represented by such a large structure as is shown at fig. 23. Prof. Smith went over it again, and agrees that there has been some oversight, that he must have figured some other which he mistook for the Grote species.

But what? This was a freqsently-recurring question, and its elucidation seemed remote indeed. So the suggestion that *thalictri* may be this mistaken species finds confirmation in an examination of these structures, and it seems that fig. 25 is no error in itself; only it is wrongly labelled.

This conclusion naturally leads to another view-point, from which we now see *thalictri* in a new light. Among the larvæ of this species a few have produced, in rearing, a form in which the stigmata are concolorous with its general tone, and which has been characterized under the varietal name *perobsoleta*. This feature of instability in the coloration of the stigmata is common to a number of species, and when series are not sufficiently complete to show gradations, there is quite a superficial difference in the appearance of the extremes by reason of contrast. Now fig. 25 of the plate in question *(thalictri)* is almost identical with fig. 26, representative of *frigida*. And what do we find to separate the latter from the form with concolorous stigmata? Nothing in the description and nothing in the types, except the usual difference between flown and bred material. It would then appear that *thalictri*, Lyman, 1905, will fall to *frigida*, Smith. 1899, at which earlier date the form having concolorous stigmata was described. There naturally arises the question at the meeting of species showing two superficial forms in the colour scheme, which is typical and which is varietal, especially in a case where it is deemed wise to name both. The prevalence of one against the fewness

of the other usually determine this, though a few chance meetings should hardly settle the matter. There are other arguments that may with propriety be considered.

Variety ought hardly to apply to the stem species, the primitive stock, even though it may have waned in numbers, giving way to later development, in whatever direction this may occur. That in *frigida (perobsoleta)* we really see represented a stem species, and in those having the spots white, a later specialized and varying form, is most probable. The general Noctuid phylogeny would point in this direction and the larvæ also bear it out. *Frigida* larvæ are the most generalized of any species, a direct opposite to *cerussata*, which is the most specialized. *Limpida* larvæ should certainly fall between the two, notwithstanding the similarity in the imagoes of the first two species. Had Prof. Smith noticed the genitalic differences in the valid *cerussata* from his figure 25, and given specific distinction, when he failed to see differences in the aggregation of flown examples at hand for study, and had these larvæ remained unknown, such discrimination would have received the disapproval of hair-splitting—a basing of species on genitalia alone. So, a varietal term for the white marked *frigida* may await further developments, the intergrades will likely appear, and if we are to name the extremes, *speciosissima*, *Harrisii*, *inquæsita* and *purpurifascia* at once stand ready with variations to swell the list. What this *frigida* development does convey is the need for close scrutiny from all sides, the importance of working out life-histories and larval comparisons, the very striking value, in this case, of structural studies. And this is no criticism, but an excuse, whereby we show that it is worth while to continue a search through a decade or more, in running down these wily borers.

It may be complained, however, that descriptions of these closely-allied moths should not be attempted without figures; we often hear such a complaint at any rate. But with this group there are things more important than figures, more important than types. How many of the latter, especially with these moths, will be of use for comparison a century hence? Certainly none in private collections. Then there is the label, that thing apart; oh, the heartburnings from a transposed label! As to figures, he must be an expert indeed who can determine all the species from figures, and a figure only represents one individual.

We need more than this. We get it the moment a life-history is published, giving food-plant and general biological data. From this point

it is an open book to all, those who feel interest may peruse, those who can discriminate always find the bookmark in place. For a large page and bold type try *pterisii*—from Ottawa to Washington, the central plains to the seaboard—that yellow, sickly, brake frond on any hillside, a conspicuous feature of the landscape when attention is called to it; date July 15th.

How clearly the light has shone over Harris's species *leucostigma* by reason of the food-plant being mentioned. His name fell through preoccupancy in the European fauna, but we could never have known what species he meant from even the good description, had that been all. Grote, at various times, placed it in the synonymy of three different species and redescribed it under a fourth. That *purpurifascia*, the universal Columbine feeder, was Harris's species we know beyond question, since that good man mentioned that its larva had feasted on the roots of a fine double Columbine in his garden. His description of one hundred and twenty words might have been cut in twain; his type—it has probably gone where all good types will ultimately go. Life-histories were generally unknown in Grote's time, and though now slowly giving up their secrets, there is great need for co-operation, especially from the West.

NEW TROPICAL AMERICAN HESPERIDÆ.

BY GEO. A. EHRMANN, PITTSBURGH, PENNA.

Leucochitonea Jason, n. sp.—This species is very closely allied to *L. locutia* of Hew., but it is not so robust in build. The colour of the head, thorax and abdomen is paler. Ground colour of the upper side of both pair of wings has a tendency to being semitransparent; basal area is not so dark. Outer margin is lightly shaded with pale brown; in this shaded space on the hind wings is a marginal row of whitish lunate spots. Fringes on the hind wings are white, on the fore wings black.

Under side: palpi, legs and abdomen white; thorax dark brown. The markings on the under side of all the wings are the same as above, but much paler. I find no special distinction in the markings in the sexes for separate description.

Exp. 2 inches. Types in cabinet of Ehrmann. Hab.: Suapure, Venezuela.

Leucochitonea Janice, n. sp.—Male: upper side, head, palpi and antennæ black; thorax black with a coat of long whitish hair-like scales. The abdomen is white with a brownish cast. Fore wings pure white, costal margin black, the apical and other margins are black; in the apical area there is a white dash running from costa to outer margin; fringes black. Hind wings pure white with a narrow black thread-like margin; fringes white.

Under side: thorax black, with a conspicuous white spot at the base of the fore wings, and a smaller reddish spot at the base of the hind wings. The abdomen is pure white, with two black lateral bars running its full length. Legs black. The fore wings are the same as above, but much lighter. Hind wings white, with a slight cast of brown scales. All the nervures are dark brown.

Exp. 1⅞ inches. Type in cabinet of Ehrmann. Habitat: Suapure, Venezuela. Note—The species that is most closely allied to *L. Janice* is *L. pastor* of Feld. from Mexico.

Leucochitonea Euphemie, n. sp.—Allied to *L. canescens* of Felder from Mexico; the thorax is more robust; the abdomen is more decidedly annulated with lighter gray and the antennæ are heavier and longer. Fore wings on the upper side: The subapical and median row of spots are more decidedly outlined and not so large and confluent as in *L. canescens*. Hind wings on the upper side: The discoidal space is more broken into smaller and irregular shaped spots; there is also a row of six small pin-point spots on the outer margin. Fringes are heavier and paler. The under side of fore wings is the same as above, but lighter.

Hind wings on the under side are pure white, with a narrow disrupted black border. Under side: palpi, thorax, legs and abdomen pure white.

Exp. 1⅝ inches. Types in cabinet of Ehrmann. Hab.: Suapure, Venezuela.

Pamphila Antenora, n. sp.—Upper side: antennæ and palpi dark brown; head dark brown, with two rows of three small white spots; thorax and abdomen dark brown. Upper side of fore wings, ground colour dark brown; at the extreme end of the discoidal there is a kidney-shaped transparent spot one-sixteenth of an inch in size; in the limbal inner space near the lower median nervure there is a square elongate transparent spot; above this on the median nervure there is another spot that is transparent and triangular in shape, pointing outwardly, and above this

in the next cell is another small square spot which is moved a little nearer the outer margin; in the apical inner space there are two small pin-point spots.

Hind wings: on the upper side the ground color is a shade lighter than on the fore wings, and on the inner space beginning at the apex and ending at the abdominal margin it is still another shade lighter; on the subapical space there is a well-defined grayish line about one-eighth of an inch long. Fringes brown, but lighter than the ground colour of both pairs of wings.

Under side: palpi, thorax and abdomen white; legs pale brown. On the fore wings the ground colour is the same as above, but a shade lighter. The apical area is suffused with a violaceus tint. All other markings are the same as above. On the hind wings the ground colour is white, with a pinkish cast; the nervures are pinkish brown.

Exp. male 1 9/16 inches. Type in cabinet of Ehrmann. Hab.: Suapure, Venezuela.

Pamphila Elenora, n. sp.—Upper side is dark brown, almost black. Fore wings have two small transparent marks in the limbal area; in the subapical space there are two very faint spots. Hind wings have a slightly lighter shading across the fascia. Fringes are scanty and black.

Under side: palpi, thorax and abdomen chocolate brown; the abdomen has two faint buff-coloured lateral bars. Legs light chestnut brown. On the fore wings the ground colour is the same as above, only a trifle lighter; there is a dash of yellow on the costa above the outer end of the discoidal cell. On the hind wings the ground colour is of a rich cinnamon brown; there is a narrow buff bar beginning on the costa near the apex and extending across the fascia to the submedian nervure.

Exp. 1 7/16 inches. Collected by E. A. Klages. Type in cabinet of Ehrmann. Hab.: Suapure, Venezuela.

Pamphila Theodora, n. sp.—Upper side: antennæ, head, thorax and abdomen brown. Both on the lower and upper side of the base of the antennæ on the head there is a conspicuous white spot; between the eyes is a sharp, well-defined white streak; the neck is of a buff colour.

Upper side of the fore wings: ground colour rich chestnut brown; there are two transparent spots in the lower area of the discoidal cell; the upper is triangular and the lower is quadrate in shape. The sub-apical area has a row of six elongate yellowish spots on the inner margin; from the base to the median area is a light brownish shade, above this is a well-defined golden-yellow spot.

Upper side of the hind wings: ground colour is a shade lighter than on the fore wings; running through the fascia from the apex to the abdominal margin is a row of seven golden elongated spots. Fringes light yellow.

Under side: palpi pale buff, thorax dark brown, abdomen dark brown, with two white lateral bars. The legs are chocolate brown. On the fore wings the ground colour is the same as above; costa light chestnut brown, tip of apex chestnut brown, the subapical spots that are on the upper side are reproduced on the under side by a broad white bar shaded at both ends with chestnut brown. The two transparent spots that are above are suffused into one irregular spot, and beneath this near the inner margin is a dirty whitish block. On the hind wings the ground colour is of a deep rich chocolate brown; there is a large pure white bar on the subcostal space; beginning at the base and ending at the apex there is a black dash in the discoidal cell; then there is another larger white bar beginning below the apex and extending across the fascia to the abdominal margin, and from the middle of the outer margin to the anal angle it is shaded with pale buff.

Exp. 1 4/5 inches. Type in cabinet of Ehrmann. Hab.: Suapure, Venezuela.

Thymele terracina, n. sp. — Female. — Upper side: the antennæ, palpi, head and abdomen are very dark brown. The thorax is dark brown, but clothed with a coat of long sage-green scales. On the fore wings the ground colour is dark brown; basal area dusted lightly with sage-green, at the outer end of the discoïdal cell there is a large U-shaped transparent spot; above this spot on the costa there are two narrow elongated spots of the same colour. Below the discoidal cell in the limbal area there is almost a straight bar of three unequal-sized lunate transparent spots; on the apical inner space there is a curved line of six transparent spots, beginning on the costa and ending on the upper median vein. Fringes brown. On the hind wings the ground colour is dark brown; the basal area is heavily dusted with rich sage-green. Fringes pure white; from the apex of the anal angle to the base the fringes are brown.

Under side: palpi ashen gray, legs light brown; thorax and abdomen dark brown, thorax clothed with long blackish-brown hair-like scales. The fore wings are of a light chestnut brown, uniform throughout, transparent spots same as above. On the hind wings the ground colour is very

dark brown, costa a shade lighter, apex ashen-gray, between the median and the lower submedian vein there is a slight scattering of white scales. Tails ½ inch in length.

Exp. 2⅝ inches. Type in cabinet of Ehrmann. Hab.: Remedios, U. S. Columbia, S. A.

Thymele viterboana, n. sp.—Upper side: antennæ brown; head, thorax and abdomen olive-green. On the fore wings the ground colour is of a rich chestnut-brown, but grows a little lighter toward the base. The basal area is slightly sprinkled with bluish-green scales. The transparent spots are situated in a similar position to those in *T. harpagus*, Felder, but not so conspicuous. The fringes are brown. On the hind wings the ground colour is much darker than it is on the fore wings, the costa is lighter. The median space, beginning at the base of the wing and shading towards the tails, is a beautiful olive-green. Fringes brown, but dentated with white on the outer margin.

Under side: palpi buff; thorax, legs and abdomen dark brown. On the fore wings the ground colour is much lighter than it is above, but with a darker shade on the outer marginal space, the spots are all the same as above. On the hind wings the ground colour is dark brown, basal and costal area lighter, then running across the fascia and outer margin there are two lighter brown bars.

Tails, 3/16 of an inch in length. Expanse of fore wings, 2¼ inches.

Hab.—Sacorro, U. S. Columbia, S. A. Type in cabinet of Ehrmann.

Thymele Guatemalaina, n. sp.—Male. Closely allied to the female of *T. proteus*, Linn., on the upper surface. The ground colour and spots are very similar, but the spots are not so distinctly separated. The basal area has a tendency to be lighter.

Under side: palpi fulvous; thorax and legs brown; abdomen ashen-gray. Fore wings light brown, inner margin still lighter; spots same as above. On the hind wings the ground colour is dark chestnut-brown; there is a narrow buff bar, 1/32 of an inch wide, that begins on the costa near the apex, and extends to the lower median vein. All fringes are a shade lighter brown than the ground colour. Tails, ¼ of an inch long.

Expanse, 2 inches. Type in cabinet of Ehrmann. Hab.: Cajabon, Guatemala, Cen. Amer.

Thymele Thiemei, n. sp.—Upper side: antennæ, head, thorax and abdomen dusky brown. On both pair of wings the ground colour is dusky brown; tails dark, almost black brown; there is a very faint bar on the fascia of the fore wings. Fringes on all the wings light brown; on the tails black.

Under side: palpi, head, thorax, legs and abdomen light brown. On the fore wings the ground colour is light brown; the fascial bar that is mentioned above is here very prominent; the apical area has a large dark brown triangular spot. On the hind wings the ground colour is the same as on the fore wings; the markings are the same as in *T. eurycles*, Lat., of Brazil. Fringes on both pairs of wings are a shade lighter than the ground colour. Tails, ¾ inch in length. Expanse, 1⅞ inch. Hab.: San Pedro Sula, Honduras, Central America.

This species seems to be very rare, for of the many hundreds of specimens that I have obtained from Dr. C. Thieme, of Honduras, it remains unique in my collection.

Thymele Borja, n. sp.—Upper side: antennæ, head, thorax and abdomen are very dark brown. On both pairs of wings the ground colour is of a beautiful fawn-brown; margins edged with dark brown; fringes a shade lighter than the ground colour.

Under side: palpi light brown; antennæ, thorax, legs and abdomen dark brown. Fore wings lighter than above; transparent spots the same as above; there are two dark wavy brown lines on the fascia. On the hind wings the ground colour has the same shade of brown as the fore wings; on the costa near the base there is a quadrate spot; aside from this there are two dark brown bars on the fascia. Tails, 7/16 inch long. Expanse, 2 inches. Hab.: Barja, Bolivia, S. America.

Goniurus Triptolemus, n. sp.—Female. Upper side: antennæ, head, thorax and abdomen dark brown. On the fore wings the ground colour is also dark brown; on the fascia there is a narrow transparent bar, which is composed of four unequal spots; the third spot from the costa is the largest. In the median cell beyond this bar is a narrow transparent spot which crosses the cell; on the subapical space is a row of four very minute transparent spots; fringes brown. On the hind wings the ground colour is dark brown, but a shade lighter than the fore wings. The tails are white; the vein that extends through them is sprinkled with brown. Apical fringes are white, but slightly intermixed with brown. Fringes on the outer margin and on the tails are very long and pure white. Abdominal fringes are shorter and brown.

Under side: the thorax and abdomen are much lighter than above; the abdomen has a dark brown bar; underneath the legs are also dark brown. On the fore wings the ground colour is lighter than above; all the same markings, but the transparent bar is more sharply defined; the inner margin is pale brown, and dusted with white. On the hind wings the ground colour is the same as the fore wings; there is a faint dark

brown shading of three bars on the fascia ; outer margin from the apex to the tails is pure white ; tails are brown, heavily fringed with white. Tails, 3/16 inch long. Expanse, 2⅛ inches. Hab.: Bagasas, Costa Rica, Ct. America. Type Ehrmann collection.

Goniurus Cleopatra, n. sp.—Female. Upper side : antennæ, head, thorax and abdomen are dark brown. On the fore wings the ground colour is dark brown ; the costa near the base to the transparent bar that extends across the fascia is white ; the bar that is on the fascia and the spots on the subapical space are the same as in *G. Triptolemus*; from the median cell the outer margin and tails are white; fringes white. On the abdominal margin the fringes are scanty and brown. On the hind wings the ground colour is dark brown ; the abdominal margin is dusted with white from the median vein, including the tails. Fringes on the apical and abdominal margin are dark brown.

Under side : palpi are white, dusted with brown; thorax and abdomen lighter than above ; there is a faint indication of two white lateral bars on the lower side of the abdomen ; legs dark brown. On the fore wings the ground colour is much lighter than the upper side ; the transparent bars and spots are the same ; the inner marginal area is white. On the hind wings the ground colour is very dark brown, slightly dusted with a lighter shade; outer margin, including the tails, is pure white excepting four faint lunate spots on the apical area. Tails, 1/16 inch long. Expanse, 1⅝ inch. Hab.: Suapure, Venezuela. Type in collection of Ehrmann. This species bears considerable resemblance to *G. Orion*, Cram., from the upper Cauca valley of Colombia, S. A., and was represented in the E. A. Klages catch by one fine example, excepting that one hind wing is missing; otherwise the specimen is perfect and fresh.

Eumesia Potomoni, n. sp.—Female. Upper side : antennæ black ; head, thorax and abdomen dark velvety-brown. On the fore wings the ground colour is a bronzy-brown. Base and margin slightly darker, and at the end of the discoidal cell there is a black dot. On the subapical space near the costa there are two minute transparent spots ; then below these dots there is a dark curved line ; this line ends in the lower submedian cell. The fringes are black. On the hind wings the ground colour is the same as that of the fore wings, but across the fascia are two dark brown bars ; the outer margin is faintly shaded with brown ; abdominal margin light brown ; fringes dark brown.

Under side : palpi and thorax are gray ; abdomen light brown. On both pairs of wings the ground colour is pale brown ; the markings are the same as above. Expanse, 1¾ inches. Hab.: Suapure, Venezuela. Type in collection of Ehrmann.

A NEW SAW-FLY OF THE GENUS XYELA.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Xyela negundinis, n. sp.—♀. Length 3 mm., or counting ovipositor, about 4; body entirely black; front dullish subsericeous; antennæ very dark brownish, the thick part a trifle longer than the filamentous; abdomen shining; ovipositor black; wings large, hyaline, iridescent, the large stigma and the nervures dilute sepia: venation agreeing with typical *Xyela*; femora black except the knees, which, with the tibiæ and tarsi, are dull ferruginous. Readily known by its black body and dark femora.

Hab.—Boulder, Colorado, April 10, 1907; collected by Mrs. Cora Bennett on flowers of *Acer negundo*. This is the third true *Xyela* from North America (cf. CANAD. ENTOM., Aug., 1902, p. 194).

A GALL-GNAT OF THE PRICKLY-PEAR CACTUS.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Mr. E. Bethel, of Denver, in the course of his botanical excursions, has noticed that the prickly-pear cacti, *Opuntia*, sometimes bear large oval galls, containing Dipterous larvæ. He recently collected some of these at Boulder, and was able to breed many of the flies, which prove to belong to an undescribed species.

Asphondylia Betheli, n. sp.

♂.—Expanse, 9 mm; wings grayish-hyaline, with coarse hair; second longitudinal vein reaching tip of wing; third longitudinal forked near its middle; fold very distinct; head and thorax slate-gray; abdomen dark olivaceous gray, with copious pale hair; legs varying from pale yellowish to pale grayish; antennæ 2 + 12-jointed, the joints cylindrical, sessile, with coarse short hairs; measurements of joints in μ (3) 289, (4) 272, (12) 204, (13) 195, (14) 195.

Pupa about 5 mm. long; pupa-shell bright ferruginous.

Gall a swollen fruit of *Opuntia*, collapsing after the exit of the flies.

Hab.—Boulder, Colorado; flies emerging May, 1907.

Like other species of *Asphondylia*, this is not marked by any strong peculiarities in the adult state, unless it be the comparatively large size. It is closely related to *A. mentzeliæ*, Ckll., which infests *Mentzelia* in New Mexico.

Mailed September 16th, 1907.

The Canadian Entomologist.

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A LIST OF PERLIDÆ FROM BRITISH COLUMBIA AND ALBERTA.

BY NATHAN BANKS, EAST FALLS CHURCH, VA.

Recently Prof. Raymond Osburn, of Columbia University, New York, turned over to me a large collection of Perlidæ made in British Columbia and Alberta. He spent two summers in this region, but collected chiefly in British Columbia. As the lot contains at least a fair proportion of the Perlid fauna of that region, I have made it the basis of a paper. I have also received some Stoneflies of this region from the Rev. G. W. Taylor and Prof. Harvey. In 1903 Mr. R. P. Currie (with Dr. Dyar and Mr. Caudell) spent a season at Kaslo, B. C. He has kindly permitted me to examine his catch of Perlidæ (about 100 specimens), which is now in the National Museum; and I have added his localities to the species in this list. All uncredited localities are from the collection of Prof. Osburn.

As most of the genera are readily separated, I have prepared a key to enable the collector to recognize them. The identification of species is a more difficult matter, and must be made, at present, by a specialist. Undoubtedly there are other species to be found in this region, but the genera are probably all represented in the list.

Perlidæ, like Lepidoptera, should be spread, at least partly, before identification. The essential specific characters are in the genitalia, but the size and markings of head and pronotum are quite constant in each form.

Five of the species are new, the most interesting being the new *Pteronarcys*.

KEY TO GENERA.

1\. In the hind tarsi the apical joint is at least a little longer than the two other joints together; anal setæ always distinct; the anal cell of fore wings usually gives off at least two veins from below.......... 2.

In the hind tarsi the apical joint is at least a little shorter than the two other joints taken together; setæ often absent; the anal cell of fore wings never gives off but one vein from below.............. 10.

2\. Anterior coxæ approximate; a series of cross-veins in anal region of fore wings......................... (Pteronarcini) *Pteronarcys*.

Anterior coxæ widely separate; rarely a series of cross-veins in anal region of fore wings........................(Perlini) 3.

3. Many cross-veins between radius and radial sector, as well as between branches of radial sector..... ....*Perlodes.*
Rarely more than one cross-vein between radius and radial sector, and not many between branches of radial sector..................4.
4. Several cross-veins in middle part of fore wing, between branches of radial sector..................................*Acroneuria.*
Few, if any, cross-veins in middle part of fore wing, between branches of the radial sector.......................................5.
5. Ocellar triangle more than twice as broad as long; usually one cross-vein between radius and radial sector near end of latter; a dark spot near pterostigma ....*Isogenus.*
Ocellar triangle not twice as broad as long; only abnormally a cross-vein between radius and radial sector near tip of latter .....6.
6. But two ocelli, and setæ very short; the pronotum broader than head.......................................*Peltoperla.*
With three ocelli...7.
7. From the anal cell of fore wings there extend below two simple veins, or one simple and one forked...............................8.
From the anal cell of fore wings there extends below but one vein, which soon forks......................................9.
8. Hind wings with but two cross-veins in the cubital area, one near base, one near tip; small greenish or yellowish species........*Isoperla.*
Hind wings with a series of cross-veins in the cubital area; radial sector of fore wings usually twice forked.................*Perla.*
9. A series of cross-veins in cubital area of hind wings; radial sector of fore wings forked twice ....*Paraperla.*
No series of cross-veins in cubital area of hind wings, only one near base, and one near tip; small greenish or yellowish species ....*Alloperla.*
10. Anal setæ obscure or absent; one branched vein from anal cell of fore wings; a series of cross-veins in median and cubital areas of fore wings..................................(Nemourini) 11.
Anal setæ distinct; one simple vein from anal cell of fore wings; no series of cross-veins in median and cubital areas of fore wings ....(Capnini) 14.
11. Second joint of tarsi subequal to first; no oblique cross-vein beyond end of subcosta.. .... *Tæniopteryx.*
Second joint of tarsi much shorter than first.................. 12.

12. An oblique cross-vein beyond end of the subcosta; wings not involute.... .... *Nemoura.*
No oblique cross-vein beyond end of subcosta.................13.
13. Wings involute; pronotum as broad as long .... *Leuctra.*
Wings not involute; pronotum longer than broad .... *Perlomyia.*
14. The space beyond discal cell longer than discal cell...... *Arsapnia.*
The space beyond discal cell shorter than the discal cell .... *Capnia.*

LIST OF SPECIES.

Pteronarcys Californica, Newport. — A female from Vancouver (Harvey).

Pteronarcys princeps, n. sp.—Head dark brown or black above, pale around ocelli; antennæ blackish-brown; pronotum black; a reddish-yellow spot in middle of front and hind margin, not distinctly connected; rest of thorax blackish; abdomen paler brown, blackish on pleura, base of venter paler. Legs dull blackish-brown; wings rather smoky to quite dark, the apical third from just before the pterostigma outward is more infuscated, and there is a more distinct black cloud below the pterostigma; venation blackish-brown; in the male the basal part of the abdomen is rather orange. The head is much narrowed in front; the pronotum has all the angles acute, and the sides are slightly rugose; the male tip of abdomen is much like *Pt. Californica*, but the scar each side is larger, and the area that separates them is narrower at tip than in that species. The ventral plate of the female (Fig. 16) has two very large hairy processes fully three times as long as in *Pt. Californica.*

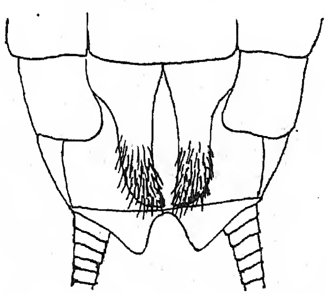


FIG. 16. — Ventral plate of female of Pteronarcys princeps.

Expanse, 70–75 mm.

One pair from Mission, B. C., April (Harvey).

Perlodes signata, Hagen.—Vancouver, 12th April (Harvey).

Perlodes irregularis, Banks.—Glacier, B. C., 21st August, and Laggan, Alta., 22nd July and 23rd August; Kaslo, B. C., June (Currie, Dyar, Caudell); Ainsworth, 11th July (Currie).

Isogenus frontalis, Newman.—Vancouver, 19th May (Harvey); Kokanee Mt., B. C., 10th August, 9,000 ft., on snow (Currie).

Acroneuria Quebecensis, Provancher.—A pair from Laggan, Alberta, 22nd July.

The female has a notched ventral plate like a specimen in the Hagen coll. at the M. C. Z., labelled *A. Quebecensis*. It is a narrower and darker species than *A. pacifica*.

Acroneuria pacifica, Banks.—Nicolum River, Hope, B. C., 13th July (Harvey); Vancouver (Harvey).

Perla sabulosa, Banks.—Port Renfrew, B. C., 3rd July.

Perla ebria, Hagen.—Vancouver (Harvey); Glacier, B. C., 22nd August; Wellington, B. C., 9th August (Taylor); Laggan, Alta., 22nd July; Banff Sp., Alta., 16th August (Currie).

Paraperla frontalis, Banks.—Laggan, 23rd August.

Isoperla decolorata, Walker.—Described from Great Bear Lake. I have not seen it from British Columbia, but it occurs in Alaska and in Eastern Canada.

Peltoperla brevis, n. sp.—Head pale, with a large, ill-defined black cloud on the middle, not extending to the mouth; antennæ brown; pronotum brown, its margin paler; thorax dark brown or black; abdomen brown; legs pale yellowish; wings subhyaline, venation brown, costal veins yellowish. Structure similar to *P. arcuata*. Head broad, bent downward, two ocelli, about as close to each other as to eyes; antennæ slender, about as long as front legs, the joints rather nodiform; pronotum very broad, slightly angulate behind on the middle, its sides straight, surface quite strongly rugose; abdomen broad and short, setæ very short, scarcely one-half as long as width of abdomen; anal plate of female (Fig. 17) large, notched at middle behind. Wings rather short and broad, many central cross-veins, radial sector forked once beyond anastomosis; anal cell with two widely-separated branches behind.

Expanse, 18–20 mm.

From Glacier, 21st August, and Port Renfrew, 3rd July.

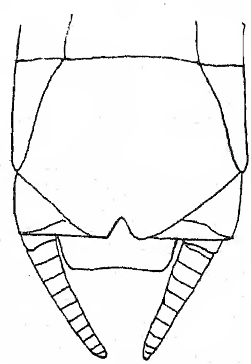


FIG. 17.—Ventral plate of female, Peltoperla brevis.

Alloperla Coloradensis, Banks. — Port Renfrew, 2nd July; Glacier, B. C., 20th July and 21st August; Laggan, Alta., 23rd August; Kaslo, B. C., 18th June (Currie); Ainsworth, B. C., 11th July (Currie); Kokanee Mt., B. C., 10th August, 8,000 ft. (Currie).

Alloperla imbecilla, Say.—Port Renfrew, B. C., 3rd July; Glacier, B. C., 20th July and 21st August; Bear Lake, B. C., 20th July (Currie); Ainsworth, 11th July (Currie).

Alloperla pacifica, Banks.—Port Renfrew, B. C., 3rd July.

Alloperla borealis, Banks.—Port Renfrew, 29th June; Banff, Alta., 17th June; Laggan, Alta., 22nd July and 23rd August.

Tæniopteryx pacifica, Banks.—Banff, Alta., 17th June; Kaslo, B. C., 18th June (Currie).

Tæniopteryx occidentalis, Banks.—Kaslo, B. C., 18th June (Currie). One specimen, the second I have seen.

Nemoura cinctipes, Banks.—Port Renfrew, 3rd July; Goldstream, B. C. (E. A. Anderson); Wellington, B. C., 29th February (Taylor); Laggan, Alta., 23rd July; Kaslo, B. C., 18th, 30th June, 16th August (Currie, Caudell).

Nemoura depressa, Banks.—Laggan, Alta., 21st August; Bear Lake, B. C., 20th July (Currie).

Perlomyia collaris, Banks.—Wellington, B. C., 26th April (Taylor).

Arsapnia grandis, n. sp.—Black; antennæ brownish; legs brownish; wings brownish, sometimes darker on the anastomosis; venation dark brown. Posterior ocelli about twice as far apart as from the eyes; pronotum about as long as broad, narrowed behind, slightly rugose each side; abdomen elongate, setæ nearly as long as the abdomen, their joints (beyond basal ones) very long and slender; hind tibiæ scarcely reaching to tip of abdomen. Wings large and elongate, three to seven costal cross-veins, also one beyond end of subcosta, apical cells longer than discal cell; in the median and cubital areas there is but one cross-vein, which is continuous.

Expanse, 22–26 mm.

Specimens from Wellington, February; Vancouver, April; and Banff, Alberta, 17th June.

Arsapnia decepta, Banks.—Banff, Alta., 17th June.

Leuctra occidentalis, n. sp.—Black; antennæ brownish; legs pale brown; dorsum of abdomen reddish; wings smoky, veins brown, costal area at extreme base brown. Head with some fine white hairs; pronotum broader than long, rather narrowed behind, its surface slightly rugose, with a broad median depression containing a median ridge. Wings rather short and broad, the radial sector forks before the upper

cross-vein, but beyond the lower cross-veins, about six cross-veins in the median series, and in the cubital series there are two, rarely three, cross-veins beyond the last of the median series; in the hind wings the radial sector forks as in the fore wings, and there are five cross-veins in an irregular transverse row. The apical claw-like joint of the male claspers is jet black; before them there is an erect, slightly curved median tooth. (Figs. 18, 19.)

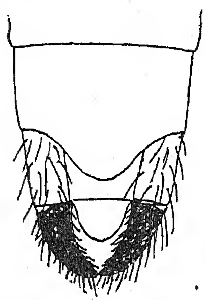


FIG. 18.—Ventral view of male genitalia, Leuctra occidentalis.

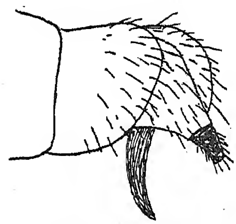


FIG. 19.—Side view of male genitalia, L. occidentalis.

Expanse, 12–14 mm.

From Laggan, Alta., 23rd August; Ainsworth, 11th July (Currie); Bear Lake, 29th July (Currie).

Leuctra augustus, n. sp.—Black; head with some short, fine white hairs; antennæ brownish-black; abdomen, beyond base, rather reddish; legs yellowish-brown, hind femora darker towards tip; wings rather fumose, venation yellowish-brown. Pronotum fully twice as long as broad, slightly rugose each side, a median depressed area with a central ridge; abdomen slender; legs very long, especially the hind pair, being plainly longer than the entire body. Wings very slender, reaching fully one-half their length beyond the tip of the abdomen, the radial sector forks beyond the lower cross-vein, and before the upper one, about six cross-veins in the median series, and in the cubital series there are three or even four cross-veins beyond the last of the median series.

Expanse, 18 mm.

From Port Renfrew, 10th August.

ON A FEW ORIENTAL GEOCORIDÆ [HEMIPTERA].

BY G. W. KIRKALDY, HONOLULU, H. I.

1. *Dieuches femoralis*, Dohrn.

Hab.—India, Kangra Valley, 4,500 feet (Oct., G. C. Dudgeon).

What I suppose to be a nymph of the 5th instar may be described as follows: Dull black; the narrowly laminate lateral margins of pronotum and of tegminal pads, some pleurital spots, coxæ, trochanters, base of femora of middle and hind femora, the fore and middle tibiæ (except apically), first segment of tarsi, pale yellowish, rest of hind tibiæ piceous. Second segment of antennæ fuscous, darkening apically, a pale ring near the base of the fourth. The pronotum is slightly impressed transversely near the base, and slightly impressed longitudinally inside the laminate lateral margins; there is a distinct collar, wider medially than at the sides. Fore femora only slightly incrassate and very feebly dentate.

Aphanus Kangricus, sp. nov.—Apparently belongs to Stal's subgenus *Xanthochilus*, and probably allied to *A. orientalis*, but the transverse impression on the pronotum is much more distinct. Dull blackish, with brownish hairs. Labium pale piceous; eyes reddish-brown, darkening outwardly; ocelli colourless. Laminate lateral margin of pronotum yellowish-brown, hind area pale castaneous, punctured with blackish. Scutellum apically fading a little, punctured with black. Ambulacra, trochanters, base of femora, first two segments of tarsi, hind margin of metasternum, etc., pale castaneous, rest of legs more or less piceous. Tegmina testaceous, subhyaline, with brown punctures; about the apical half brown-fuscous, with a large subtriangular pale yellow spot on the outer half of the middle; basal half of membrane smoky, except one pale, undulating vein and two spots; apical margin irregularly and faintly smoky.

Form apparently that of *A. orientalis*, but the pronotum is impressed transversely basad of the middle, the lateral margins of the pronotum laminately keeled. Antennæ as in *A. orientalis*. Labium reaching a little beyond the middle of the mesosternum. Clavus with three rows of punctures. Fore femora more strongly incrassate than in *A. orientalis*, and have two strong submedian spines and a few feeble ones; tarsi dilated at the apex. Hind femora not dentate. Length, 8⅛ mill.

Hab.—India, Kangra Valley, 4,500 ft. (June, G. C. Dudgeon).

Bedunia, Stal.

1. *B. taprobanes*, sp. nov.—Blackish. Ocelli red. Antennæ blackish-fuscous, second segment (except the apex) pale fuscous; basal half of 4th (except base) white. Labium yellowish-testaceous. Lateral margins of

hind lobe of pronotum yellowish-fuscous. Collar very short, ferruginous. Two ferruginous spots on the middle of the scutellum. Tegmina brownish-yellow; clavus and basal half of corium largely fuscoferruginous, with blackish-brown punctures; apical half of corium dark fuscous-brown, a large pale yellow spot subapically. Membrane dark fuliginous, marked slightly with yellow. Fore femora, apex of middle femora, apical third of hind femora, apices of tibiæ, fuscopiceous, rest yellowish. *Labium* reaching the middle coxæ, *first segment not nearly reaching the base of the head*, but about the hind margin of the eyes. Clavus rather irregularly punctured in four rows. Fore coxæ strongly spined. Length, 7½ mill.

Hab.—Ceylon, Pundaluoya (July).

This was sent to me about ten years ago by Mr. E. E. Green. It seems to be rare, as it is not described in the "Fauna of India." My example has unfortunately lost its abdomen, but it is otherwise perfect, and the species is distinct.

Edulica, Distant.

Distant places *Edulica* in the Clerardini. Apart from the general habits, which places it in his "Rhyparochromaria" perhaps, the labial structure at once removes it from the Clerardini; in *Edulica* the first segment alone is equal in length to the head, while the principal character of the *Clerardini* is that the first two segments together are about this length.

Macropes, Motsch.

1. *M. sinhalanus*, sp. nov.—Black (shining on head and pronotum), with sparse, very pale yellowish hairs; apex of tylus and the first and second antennal segments pale ochraceous, third and fourth dark fuscous. Clavus piceous, very narrowly margined with testaceous; rest of tegmina opaque milky-white, inner margin (very narrowly) of corium, and a broad suffused band across the middle (somewhat obliquely covering junction of corium and membrane) dark fuscous. Labium and legs more or less piceous, first two segments of tarsi brownish-testaceous, hind tibiæ dark piceous, antennæ 4, 10, 11, 20. Labium reaching to about the fore coxæ. Pronotum anteriorly and posteriorly punctured; a double, rather feeble line of punctures down the middle; roundly curved outwards laterally, sides of hind area parallel, posteriorly emarginate. Tegmina reaching to apical margin of third segment. Fore femora comparatively strongly spined. Length, 5¼ mill.

Hab.—Ceylon, Peradeniya. Mr. E. E. Green sent me this some ten years ago, and it has remained undescribed up till now.

DIPLONYCHUS, LAPORTE (=HYDROCYRIUS, SPINOLA), AND ITS RELATION TO THE OTHER BELOSTOMATID GENERA.

BY J. R. DE LA TORRE BUENO, NEW YORK.

The genus *Hydrocyrius* was founded in 1850 by the Marquis Maximilian Spinola,[1] and since then it has figured under that name. It has been redescribed several times under different appellations. Stål called it *Ilyotrephes*;[2] A number of other authors[3] have treated it as a species of the old genus *Belostoma*, Auctt. (now *Amorgius*, Stål). But the question nevertheless arises, "Is this the true generic name, or have we another valid appellation for the genus?" In consulting a number of works and papers for material for these notes on the affinities of *Hydrocyrius*, Laporte de Castelnau's[4] definition of the genus *Diplonychus* attracted my attention. It reads thus: "Antennæ breves, sub oculos in excavatione insertæ, articulis 4; ultimis 3 subpectinatis. Rostrum breve, arcuatum, acuminatum. Tarsi articulis 2; ungulis 2.

"Faciès des Bélostomes; l'abdomen des femelles est terminé par deux longs filets.

"Ier Sous-genre. *Diplonychus*, Mihi.

"Corpus elongatum; tarsorum anticorum unguiculis elongatis. *Belostoma rustica*, FAB., 106, 3.

"Et plusieurs autres espèces exotiques.

"IIme Sous-genre. *Sphærodema*. Mihi, etc."

Further on in the same work (p. 83) he states: "C'est par erreur que j'ai indique (page 18) le *Belostoma rustica* de Fabricius, comme type du genre *Diplonichus* (!). Cet insecte est un *Sphærodema*."

Now, according to my understanding of Kirkaldy's views on the historical method of type fixation,[5] this leaves the subgenus without a type species. The fact that subsequent authors have raised the subgenus to full generic standing, and that under it they have grouped Belostomatids with two *short* claws, in no way invalidates the original description, which specifically indicates that in the typical subgenus *Diplonychus* the claws of the anterior tarsi are *elongate*. Moreover, the

1. 1850, Mem. Mat. Soc. Modena, xxv, 146.

2. 1856, Ofv. Vet. Ak. Förh, p. 358.

3. Dufour, Belostoma algeriense; Lucas, B. grande; Guérin, B. capitatum; Coinde, B. cosmopolitanum.

4. 1832, Essai d'une Class. Hém. p. 18 (of separate).

5. 1905, Proc. Ent. Soc. Wash., Vol. XII, pp. 27 to 28.

body is stated to be *elongate.* Now, no species of the genus or genera variously known as *Atomya*, Spinola; *Appasus*, Amyot and Serville; *Cyclodema*, Dufour; *Nervinops*, Dufour; *Sphærodema*, Auctt., and *Diplonychus*, Amyot and Serville, of those that I have seen (and my collection contains nearly all the known species which at one time or another have been ranged in these genera), is *elongate.* All are more or less ovate. This view was enunciated by Leon Dufour in his "Essai Monographique sur les Bélostomides,"[6] who then said under *Hydrocyrius*, Spin. (p. 385): "On a peut être mal interpretè le genre *Diplonychus* fondé en 1832, par M. de Laporte. Cet auteur dit positivement que les *Diplonychus* ont le faciès des *Belostoma;* que leur corps est *elongatum*, que les tarses antérieurs se terminent par deux ongles *elongati.* Je le demande aux esprits sérieux, ces traits sont-ils applicables aux *Diplonychus* des auteurs de l'epoque? Quant à moi qui ai etudiè à fond cette question, j'ai l'intime conviction que le Diplonychus de M. de Laporte a du être primitivement, fondé sur un grand *Bélostome*, analogue à mon *Algeriense.*"[7]

Prof. Montandon has discussed the synonymy of this genus in one of his able essays on Water-bugs,[8] and his conclusion is that *Diplonychus*, Lap., being unidentifiable, it is better dropped for the defined *Sphærodema*, Lap., although he suggests that Laporte may have had before him a nymphal Belostomatid (which is two-clawed) or a species of *Hydrocyrius*. In his discussion, however, it is evident that he is unfamiliar with Laporte's later note cited above, in which he removes *Belostoma rustica*, Fab., from the subgenus, and states that it is a *Sphærodema*. While it is true and proven that nymphal *Belostomatids* are two-clawed, none of those known to me have the so-called "filets abdominaux" or "caudal setæ." These are characteristic of the adult only, and are *not* sexual characters, but rather pertain to the respiratory apparatus, and are parts of the highly specialized and modified sixth abdominal segment. I am familiar with all but one of the described Belostomatid genera, and know about fifty species, but of these the only ones that have the "facies des Belostomes," and are at the same time two-clawed, are the two species of *Hydrocyrius* I possess.

6. 1863, Ann. Soc. Ent., Fr. (4), III.

7. =columbiæ, Spin. (Hydrocyrius).

8. 1900. Notes s. qqs. genres de la Fam. Belostomidæ—Bull. Soc. Sci. Buc. An. IX, No. 2 and 3, pp. 1 to 8 (of separate).

My friend Kirkaldy, in his recently-published list of genera,[9] rejects Montandon's work and adopts *Diplonychus*, Lap., as the true generic appellation of the *Sphærodema-Appasus-Nervinops-Cyclodema-Atomya* series, but in consideration of the facts I have here set forth, the correct synonymy, which may be intercalated in Kirkaldy's generic list, p. 151, is as follows :

Genus 5.—*Sphærodema*, Laporte, 1832, Essai Hem., 18 (type fig. in Fieber, etc.). The rest of the synonymy as in Kirkaldy, l. c .... Type *annulata*, Fabr.

Genus 7.—*Diplonychus*, Laporte, 1832, Essai, p. 18.
= *Hydrocyrius*, Spinola, 1850, etc. (The remainder of the synonymy as in Kirkaldy, l. c., p. 152.)

II.

What is the true systematic position of *Diplonychus*, Lap. (= *Hydrocyrius*, Spinola)? Kirkaldy in his work cited places *Hydrocyrius*, Spin. (recte *Diplonychus*, Lap.), between *Limnogeton*, Mayr, and *Nectocoris*, Mayr, this genus being placed last in the family. Going further back, Mayr[10] places it between *Benacus*, Stål, and *Limnogeton*, Mayr, and so does Stål.[11] Dufour,[12] however, seems to have been the only one of the older entomologists to have had the true conception of the affinities of *Diplonychus*, Laporte (= *Hydrocyrius*, Spinola). He places it between *Belostoma*, Auctt., nec Latr. (= *Amorgius*, Stål), and *Zaitha*, Am. & S. (= *Belostoma*, Latreille). Agreeing with Dufour, I believe the linear relationship of the Belostomatid genera is more nearly expressed by the following order :

1. *Benacus*, Stål.
2. *Amorgius*, Stål.
3. *Diplonychus* (Laporte), Bueno.
4. *Belostoma*, Latreille.
5. *Abedus*, Mayr.
6. *Limnogeton*, Mayr.
7. *Nectocoris*, Mayr.
8. *Sphærodema*, Laporte.

9. 1906, List of the Genera of the Pagiopodous Hemiptera, etc., Tr. Am. Ent. Soc., XXXII, No. 2, pp. 117 to 156 and 156a.

10. 1871, Die Belostomiden, Verh. Zool. bot. Geo. Wien., XXI.

11. 1865, Hem. Afr., III.

12. 1863, Ess. Mon. s. l. Belost., Ann. Soc. Ent. Fr. (A.) III.

These genera may be separated by the following table:

1. (2) Anterior femora not sulcate . . . . I, *Benacus*, Stal.
2. (1) Anterior femora sulcate.
3. (10) Anterior tarsi with two claws.
4. (9) Claws of anterior tarsi of equal length, minute.
5. (8) Anterior femora more or less incrassate, much larger than tibiæ.
6. (7) Species with two sulci between the eyes . VII, *Nectocoris*, Mayr.
7. (6) Without such sulci . . . . VIII, *Sphærodema*, Lap.
8. (5) Anterior tarsi scarcely incrassate, but little larger than tibiæ . . . . VI, *Limnogeton*, Mayr.
9. (4) Claws of anterior tarsi of equal or unequal length, elongate . . . . III, *Diplonychus*, Lap. (Bueno).
10. (3) Anterior tarsi with one claw.
11. (14) Head conically produced, rostrum long, thin.
12. (13) Membrane of hemelytra large . . . . IV, *Belostoma*, Latr.
13. (12) Membrane of hemelytra much reduced . . . . V, *Abedus*, Stal.
14. (11) Head not conically produced, rostrum short, stout . . . . II, *Amorgius*, Stal.

A brief study of the three genera, *Amorgius*, Stål ; *Diplonychus*, Laporte (Bueno), and *Belostoma*, Latreille, is necessary in order to elucidate my position. The difference between the adults of the three genera will appear from the following comparisons :

The Head.—In *Amorgius* we have the front truncate, projecting but little beyond the eyes, which are in general longer than broad. The vertex also is not wider than one eye, and is more or less conical in shape, as is *Belostoma*. But in *Diplonychus* the vertex is not wider than the eye, while in *Belostoma* it is. In both the eyes are wider than long. The rostrum in *Amorgius* is quite short and stout, and in *Belostoma* very long and slender, whilst in *Diplonychus* it is moderately long, and as stout as in the first-named genus. The prothorax is trapezoidal in all three genera, but is much less narrowed anteriorly in *Diplonychus* than in the other two, which gives it a massive aspect. The scutellum also is apparently large, due to the more stout general build of this bug. The hemelytra are much the same in the three except for slight variations, which are no greater than those occurring in the different species of any one genus. *Diplonychus* agrees with *Amorgius* in the general outline, the sides being more or less parallel, whilst in *Belostoma* the body is more or less pointed oval posteriorly. We now come to the under side of the body and the legs. The

genital plate in *Diplonychus*, as in *Belostoma*, is entire, while in *Amorgius* it is deeply fissured medianly. In shape it is much the same throughout the family, although much shorter in *Belostoma* than in the other two genera. The tibiæ of the third pair of legs in *Amorgius* is flattened, more or less broad, heavily fringed with long hairs, and terminates in two long claws. *Belostoma* and *Diplonychus*, on the other hand, have prismatic posterior tibiæ, and the hairs are shorter. The form of the intermediate tibiæ is the same in each genus as the posteriors. It is in the anterior pedes that the most interesting features occur. The femora are incrassate in all three, but while in *Belostoma* they are only moderately so, in *Diplonychus* and *Amorgius* they are greatly so. All three genera have them deeply sulcate for the reception of the tibiæ, which are of similar shape in all. The tarsal joints are moderately long and equal in *Belostoma*. In *Amorgius* and *Diplonychus* they are small and unequal. The profound yet most significant character is contained in the anterior tarsal claws. These are single, long in *Amorgius*, and small in *Belostoma*. In *Diplonychus* they are *double* and *long*, though the outer is but half the length of the other in the two species known to me, while in one described by Mayr they are of equal length. The importance of this structural feature can be appreciated only from the study of the nymphs taken in conjunction with the changes that occur in the claws during development. As various authors[13] have from time to time pointed out, Belostomatid nymphs of the several genera are all two-clawed in the anterior tarsi throughout all, or in some of the earlier, instars. In general, the nymphs of *Amorgius* possess two elongate equal claws up to the last moult, one of which they lose at that ecdysis, and the adult has only one more or less long tarsal claw. In the several nymphs of *Belostoma*, as I have elsewhere noted,[14] some lose the one claw early, others by slow stages,[15] at some one of which the length of one claw bears the same relation to the other as the adult in *Diplonychus* known to me. In this last-named genus, however, the nymph in the last instar has the two long claws of equal length,[16] as in *Amorgius*. At the last moult in two species one of these claws is reduced to half the length of the other, while in the third, known to me only by description, the two equally long claws are preserved.

13. 1863, Dufour, op. c.; 1871, Mayr, op. c.; 1901, Howard, Ins. Bk., p. 279; 1906, Bueno, CAN. ENT., XXXVIII, p. 197; and others.

14. Op. c.

15. Cf. *B. fluminea*, op. c.

16. Duf., Ann. Soc. Ent. Fr. (A.)III, p. 386, description of nymph in last instar of *Hydrocyrius algeriensis*.

The egg-laying habits of *Diplonychus* are as in *Belostoma*,[17] in which genus (as well as in several others of the family) the female fastens the eggs on the back of the male. *Amorgius*, however, deposits its ova under a convenient log or plank in a damp spot at the water's edge, glued to it, which also appears to be the habit with *Benacus*.[18] To recapitulate: *Diplonychus*, Lap. (Bueno), approaches *Belostoma*, Latreille, in the shape of the eyes, the genital plate, the posterior and the intermediate tibiæ, and in the manner of oviposition. It is close to *Amorgius*, Stål, in the form of front and vertex, general shape, anterior femora, tibiæ and tarsal joints, and in the claws in the nymph. It is intermediate in the rostrum, which tends to the *Amorgius* side. It resembles both genera in the shape of the scutellum, in the membrane, of the hemelytra, and in most of the other features not dwelt upon. The differences are the general shape of the head, which is very broad, the shape of the prothorax, and, above all, in the possession of two long claws in the adult, of equal length in one known species, and unequal in the other two. From this last character, taken in conjunction with the nymphal structure of these appendages in the two allied genera, as well as in the others of the family, we may in fairness conclude: 1st. That *Diplonychus* is an intermediate form in the chain of development linking the Amorgioid forms to the Belostomoids; and 2nd. That it is in all likelihood the most primitive form of the Belostomatid series, from which arise the genera *Amorgius*, Stål, and *Benacus*, Stål, on the one hand, and *Belostoma*, Latr.; *Abedus*, Mayr; *Limnogeton*, Mayr; *Sphærodema*, Lap., and *Nectocoris*, Mayr, on the other.

To sum up, it would appear that *Diplonychus*, Laporte (Bueno), is nearly allied to both *Belostoma*, Latr., and *Amorgius*, Stål, with closer leanings to the latter, and that its systematic position is as given in the linear arrangement between these two genera.

III.

The species and distribution of *Diplonychus*, Lap. (Bueno), are moot questions. A great deal of confusion has arisen from the description and rediscription of what is said to be one species from several widely-separated localities. I recognize three species, but it is more than likely that some of those reduced to synonymy may be later revived as our knowledge of

17. 1906, Bueno, op. c. p.; 1900, Horvath in Lit., quoted by Mont. Bull. Soc. Sci. Buc. An. IX, No. 2 and 3, p. 8.

18. 1889, C. M. Weed, Studies in Pond Life, Bull. Ohio Agr. Exp. Sta., Tech. ser., I, No. 1; 1907, Needham, Ent. News, XVIII, pp. 113 to 116.

the genus and the group at large increases. They are *Diplonychus columbiæ*, Spinola; *D. punctatus*, Stål, and *D. rectus*, Mayr, the two first of which I am acquainted with in nature, and the latter by description. They may be separated as follows:

KEY TO THE SPECIES OF *Diplonychus*, Laporte.

1. (2) Anterior tarsi furnished with two claws of *equal* length .... III, *rectus*, Mayr.
2. (1) Anterior tarsi furnished with two claws of *unequal* length.
3. (4) Disk of prothorax punctate, with two pronounced round foveæ, hemelytra more or less punctate .... II, *punctatus*, Stål.
4. (3) Disk of prothorax slightly punctate, with two shallow foveæ and two sulci converging posteriorly toward the transverse sulcus, hemelytra impunctate .... I, *columbiæ*, Spinola.

I.—*Diplonychus columbiæ*, Spin.

Hydrocyrius columbiæ.

1850.—Spin., Mem. Nat. Soc. Modena, XXV, 146.
1863.—Duf., Ess. Mon. Bel., Ann. Soc. Ent. Fr. (4), III, 385.
1864.—Lucas, Ann. Soc. Ent. Fr., IV., 228.
—Signoret, op. c., 224.
1865.—Mayr, Reise der Novara, Hem., p. 183.
1871.—Ibid, Die Belostomiden, Verh. Zool.-bot. Ges. Wien, XXI, 429, part.
1886.—Uhler, Ch. List, p. 28.
1895.—Schmidt (Schwedt), S. B. Ges. Nat. Freunde Berlin, p. 38.
1900.—Montandon, Bull. Soc. Sci. Nat. Buc. An. IX, No. 2 and 3, p. 4.
1901.—Champion, Biol. Cent. Am., Het., II, 362.

Belostoma grande.

1849.—Lucas, Hist. Nat. An. Art. Alg., III, 43.
1862.—Ibid, Ann. Soc. Ent. Fr., II, 404.
1864.—Ibid, op. c, IV, 227.

Ilyotrephes herculeus.

1853.—Stål, Öfv. Vet. Ak. Förh., V, 264.

Hydrocyrius herculeus.

1866.—Stål, Hem. Afr., III, 181.

Belostoma algeriense.

1855.—Duf., Mem. Soc. Ac. Sci. Liege, X, 187, pl. I, f. 1.
1862.—Lucas, Ann. Soc. Ent. Fr. II, 404.

Belostoma capitatum.

1856.—Guérin, in Sagra's Hist. Cuba, An. Art., VII, 420.

1865.—Mayr, Reise der Novara, Hem., p. 183.

Belostoma cosmopolitanum.

1863.—Coindé, Rev. Mag. Zool., 33.

1864.—Lucas, Ann. Soc. Ent. Fr., IV, 227.

Ever since this species was first described, it has been recorded from time to time from the most widely-separated places. The distribution, as given by Dufour and Mayr, is as follows :

America.—Mexico and Cuba.

Africa.—Algeria, Khartoum, Guinea, Caffraria and Madagascar. This distribution, however, seems to me too scattered to be real.

Mexico is given following Spinola, while under the supposition that *Belostoma capitatum*, Guér., is the same insect, the Cuban record comes into existence. Madagascar is given by Mayr, on the ground that *punctatus*, Stål, described from the Island, is merely a synonym of *columbiæ*, Spinola. This is not the case, however, as the former is readily distinguishable from the latter, as may be seen by the analytical table. The homogeneity, so to say, of the other localities, added to the fact that in Algeria at least the Hemipteron seems to have been fairly common, would appear to establish them as real beyond reasonable doubt. In addition, I have a specimen from German East Africa. It may, therefore, be safely stated that the bug is African, and that it is spread over the greater part of the continent. Its existence in America is problematical, to say the least, and although Champion refers to it in Biologia Centrali Americana, he does not list it, but states as his opinion that "In addition to the species enumerated here, two others have been recorded from Mexico, but further evidence is required before they can be included in our list ; these are *Hydrocyrius columbiæ*, Spinola," etc. In confirmation of this, my personal endeavours to secure the bug, either from Cuba or Mexico, have thus far proven fruitless. It seems best, therefore, to ignore the American records, at least till they are absolutely confirmed or disproved.

II.—*Diplonychus punctatus*, Stål.

Hydrocyrius punctatus.

1865.—Stål, Hem. Afr., III, 182.

H. columbiæ, partim.

1871.—Mayr, Die Belostomiden, Verh. Zool.-bot. Ges. Wien, XXI, pp. 429, 430.

This bug was reduced by Mayr to synonymy, and evidently he did not consider it more than a local variety. In fact, he says so in so many words (op. c., p. 430). The species, however, is well marked. Stål recorded it from Madagascar originally, and it does not appear to have been mentioned since. I possess a specimen from that Island. It is apparently restricted to that territory.

III.—*Diplonychus rectus*, Mayr.

Hydrocyrius rectus.

1863.—Mayr, Verh Zool.-bot. Ges. Wien, p. 359.

1864.—Signoret, An. Soc. Ent., Fr. (4), IV, 224.

1871.—Mayr, Die Belostomiden Verh Zool.-bot. Ges. Wien, XXI, 430.

No other records are to be had of this well-defined species than that of the author, who gives Sierra Leone (West Africa) as its habitat. It is 10 mm. shorter than *punctatus*, Stal, from which the character given in the table at once separates it.

In conclusion, I wish to express my thanks to Mr. G. W. Kirkaldy, whose independent investigation when I called his attention to the generic emendation proposed, confirmed the conclusion I had already reached. He added in his letter other important synonymical matter, which it is to be hoped he will make public ere long.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 23.

Fumigation with Hydrocyanic Acid Gas for Bedbugs.

BY GLENN W. HERRICK, AGRICULTURAL COLLEGE, MISS.

Fumigation of a Large Building.

For the past two years we have used hydrocyanic acid gas on an extensive scale with considerable success, and thinking that the experience gained might be of benefit to other workers who may be confronted with the same problem it seemed worth while to give an account of the work and method of procedure.

Our dormitory building, in which the work has been done, is a large 4-story structure in the form of an E, and contains, all told, 253 rooms of different sizes on the different floors. We use approximately the formula recommended by Dr. L. O. Howard in Circular 46, s.s., the only change

being that we consider 30 cc. as the equivalent of a fluidounce. It takes about 340 pounds of cyanide (98% pure) and the same quantity of sulphuric acid to give the building a single treatment, not including the halls, which are thoroughly scrubbed with lye and water.

Our first work was to measure the rooms and compute the cubic contents of each. With the exception of a few corner rooms, they are as follows :

Floor.	Cu. Ft.	Cyanide.	Water.	Acid.
4	1960	1¼ lbs.	1200 cc.	600 cc.
3	2352	1½ lbs.	1440 cc.	720 cc.
2	2352	1½ lbs.	1440 cc.	720 cc.
1	2744	1¾ lbs.	1680 cc.	840 cc.

In computing the amounts of cyanide, water and acid to be used, we always raise the cubic feet in any given room to the next even hundred. For example, the capacity of each room on the fourth floor, which is 1960 cubic feet, was considered to be 2000 cubic feet.

In the fumigation we attempted to treat one-fifth of the building each successive day. It is to be noted that there are three wings and a long front, twice as long as each wing. This affords a natural division of the building into five parts, each division containing an average of about 50 rooms. We begin on one wing by setting six men to caulking the windows and transoms with strips of newspaper about four inches wide and thoroughly soaked in water. The paper is first torn into strips and then placed in pans of water, where it is allowed to remain until thoroughly soaked. These wet strips are then quickly and effectually applied to the top, bottom and sides of each window and transom or other cracks that may be found in the room.

At the same time two men are placing ordinary china wash-bowls in each room with the proper amount of water and acid in each. Beside each bowl is also placed the proper amount of cyanide on a piece of newspaper spread flat on the floor.

We usually try to begin at such a time in the day that the rooms in one wing will be ready for fumigation at about 6 p.m. It takes the force

enumerated above about four or five hours to do this, so that we should begin about 1 p.m. As a matter of fact, the time varied considerably owing to unforeseen additional labour. When everything is ready two men go to the top floor, and beginning at one end of the hall, pass into opposite rooms, one man on each side of the hall, gather the edges of the newspaper in the fingers and pour the cyanide *directly* into the acid and water and walk quickly out of the room, closing the door after them. There is not the slightest danger, apparently, in pouring the cyanide directly into the acid and water if one does it coolly and quickly and holds the breath for a few seconds until the door is reached. Of course, the chemical reaction is very rapid and begins immediately, but by reaching the hand out over the bowl and turning the head a little away and holding the breath a few seconds we have never in all of our work—and we have always done it that way—experienced the slightest annoyance from the gas. By passing rapidly down the hall from room to room and floor to floor two men will set the whole 50 rooms off in ten or fifteen minutes.

Our success last year was very gratifying indeed, although we had some complaints of bedbugs in a few rooms late in the session. This, in most instances, could be traced to some old wooden bedsteads that had not been fumigated, and which I supposed were to be thrown out and destroyed, but which were used afterwards by students who, coming late in the session and finding these old bedsteads, utilized them instead of buying new ones. In a few cases I believe it was due to the large cracks around the doors, through which the gas dissipated itself into the halls. To obviate this difficulty, we tried a plan this year that seemed to work very well, and, I believe, will prove more effective.

Instead of caulking all the rooms in a division we simply caulked the rooms on the top floor of that division first and then fumigated them at once. As the fumigator would close the door of a room two men, who stood ready with water-soaked strips of paper, would quickly seal the cracks around the edges of the door and the keyhole. These two men would caulk a door in less than two minutes, and the rooms must have been made as tight as is possible under average conditions. All of the rooms on that floor were treated in this way, after which the force passed to the floors below in succession, treating each in the same manner.

Although it took about one hour to treat each floor, not the slightest inconvenience or annoyance was experienced by the men from the gas on the floor or floors above. There is also another advantage in this method: Where the sun shines in windows the strips of paper, although we use three thicknesses and soak them thoroughly, are apt to dry and curl away from the cracks if left too long. By treating a floor as soon as ready we obviate this difficulty and get the full effect of the gas.

Some Results of the Use of This Gas Against Bedbugs Under Varying Conditions.

Desiring to know the effect of hydrocyanic acid gas on bugs hidden away in mattresses, blankets, comfortables, etc., we tried the following experiments:

1. Three bugs were placed in a perforated pill box and then wrapped in excelsior, three inches all around, and this in turn in some domestic to imitate ticking.

2. Three bugs (one adult, one one-third grown and one very young) were placed in a similar box and then carefully wrapped in two folds of a thick comfortable.

3. Three bugs (two adults and one one-third grown) were placed in a similar box and carefully wrapped in cotton-batting to the depth of two inches.

4. Two bugs (one adult and one two-thirds grown) were placed in a similar box and wrapped in two folds of a thick woollen blanket.

5. Six bugs were put in a vial 3½ inches deep and one inch in diameter, and the latter stopped with an inch cork which had been punched twice with a pair of dissecting-forceps with curved points. The holes thus made had apparently closed up owing to the spongy nature of the cork, but I found afterwards that I could readily force air through them by placing the cork between my lips.

6. To serve as checks several bugs in perforated boxes were placed about the room at different heights from the floor.

In every box of bugs wrapped in different materials several new-laid eggs were placed to determine the effect of the gas upon the hatching of the same.

The room in which the fumigation was done measured 14 x 8 x 8, and contained 896 cubic feet. We used 10 ozs. of cyanide, 300 cc. of acid

and 600 cc. of water, allowing the room to remain closed 14 hours. We made a slight mistake in our computation, and used 1 oz. more of cyanide than our formula called for.

The results were surprising and very gratifying. Every bedbug in every case was killed.

The fumigation was done June 1, and as I write, June 12, none of the eggs have shown any signs of hatching. It is impossible for me to say whether they are fertile or not, but it is reasonable to suppose that they are. We obtained them by confining a dozen or more adult bugs in a large vial, and on the second day we found eggs in abundance. The eggs must have been formed in the females under natural conditions in the bedsteads from which they were taken, and very likely the bugs were fertilized there before we collected the females.

Acknowledgments are due to Mr. R. W. Harned for his aid in the execution of the fumigation done this season.

SOME NEW SPECIES OF WESTERN GEOMETRIDÆ.

BY JOHN A. GROSSBECK, NEW BRUNSWICK, N. J.

Gymnocelis remorata, new species.—Expanse, 16–17 mm. Head, thorax and abdomen pale creamy-white, the abdomen somewhat the darkest. Wings whitish, variegated with shades of small pale brown patches, which show up the ground colour in a series of transverse white lines. On the primaries the first of these white lines is near the base, inwardly edged with brown and outwardly fused with the ground colour. Intradiscal line geminate, begins at costa and extends outward to cell, then inwardly, dentate to inner margin. Median line geminate, originates at centre of costa and extends outwardly, the inner line bordering the discal spot outwardly, then runs obliquely dentate to centre of inner margin. Extradiscal line dentate, geminate, subparallel with median line. All these lines show up most prominently on the costal area of the wing; less so on the remainder of the wing, yet readily to be followed. Subterminal line single, finely dentate throughout its course. Terminal line brown, sometimes interrupted by white at the venules. The brown patches appear most plainly on the costa, especially between the intradiscal and median lines, immediately outward of the median line and between the extradiscal and submarginal lines. A rather prominent

blotch is near the outer margin between M1 and M3, and another less distinct is at the anal angle; through the centre of these blotches the subterminal line runs. Cu. is usually lined with dark brown scales on the basal half or centre, and the veins of the media are also slightly marked with a similar colour inwardly of the extradiscal line. Discal spot dark brown, longer than broad, very distinct. Fringe whitish, silky, pale brown at the veins. Secondaries with about four white lines on basal half of wing, beginning at inner edge and disappearing toward centre. A geminate sinuous white line crosses at outer two-thirds and corresponds to the extradiscal line of fore wings. Subterminal line white, wavy. Terminal line brown, sometimes interrupted, distinctly wavy at inner angle. Discal spot dark brown, elongate, distinct. Beneath silky, cream coloured, the delineations of upper side faintly showing on costa. Discal spots faint and rather small.

Described from a number of specimens, representing both sexes, in the Rutgers College collection.

Habitat: Yuma County, Arizona, April 11–20.

Sciagraphia Yavapai, new species.—Expanse, 26 mm. General colour leaden-gray, with a reddish-umber hue and with black atoms sparsely scattered over the body and wings. Costa of primaries flesh coloured, marked with small but distinct black flecks on basal third and larger ones on the centre. Intradiscal line ochre-brown, narrow, begins one-fourth out on costa, and is slightly outcurved to inner margin. Extradiscal line concolorous with the first, begins on costa over two-thirds out from base, extends outwardly to M1, then with a faint in-and-out curve to Cu. 1, and with a sharp inward semicircle to inner margin, ending two-thirds out from base. This line is marked on the costa by a distinct, rather large black spot, on the inner margin by a smaller one and by five dots on the veins from M1 to Cu. 2 inclusive. Terminal line a series of small intervenular spots. The basal and median areas are uniform in colouring, the outer area slightly darker and with a dark shade-spot in the centre bordering the extradiscal line. Discal spot an irregular elliptical ring with several ochre-brown scales at each end, indicating a median transverse line. Secondaries with numerous inconspicuous transverse dashes, giving the wing a finely-mottled appearance. A transverse ochre-

brown line extends from middle of wing to inner margin. Discal spot round, dusky. Beneath whitish-gray, the outer portion darker and all veins lined with ochreous; both wings profusely marked with minute transverse dashes that show up sharply on the light background. Discal spots distinct, rather large.

Type: One female in the collection of the writer.

Habitat: Yavapai County, Arizona, Aug. 20 (Hutson).

Gonodontis ocellaria, new species.—Expanse, 44–47 mm. at greatest width. Front, palpi and thorax bright buff, the abdomen pale buff. Primaries with apex acute, outer margin scalloped between the veins, extending outward from apex to M3, then inward to rounded anal angle. Colour uniformly bright buff, washed with a faint grayish shade, most perceptible toward outer margin; costa with a number of slate-coloured specks, the largest at the beginning of the extradiscal line. Intradiscal line not strongly marked, whitish, bordered externally by a pale gray shade, beginning one-third out from base on costa, regularly outcurved to inner margin, where it almost disappears. Extradiscal line well defined, whitish, with a grayish border, internally originates on costa less than one-fourth in from apex, extends with an outward curve to Cu. 2, thence with a faint inward curve to inner margin. Distance between the two lines on costa double that on inner margin. Discal spot a clear white dot edged with brown. Marginal line deep orange; fringe pale yellow, marked with brown at the apices of the scallops. Secondaries brighter than primaries, more of a salmon colour, paler at base; outer margin evenly rounded and scalloped between the veins. A brown line crosses the centre, is broadest in the central portion, obsolete at the costa and faint at the inner margin. Beneath both wings pale buff, except at inner margins, where they are flesh-coloured. Costa of primaries and costal and basal areas of secondaries sparsely marked with brown specks. The transverse lines of upper surface, save intradiscal line of primaries, faintly reappear, and are marked with venular brown spots, which tend to join in the centre of the hind wing. Discal spots brown, small, present on all wings.

Types: Three males in Rutgers College and in the collection of the writer.

Habitat: Minnehaha, Arizona, Oct. 2 and 3 (Hutson).

This is the first American species that has scalloped wings like the type of the genus, *G. bidentata*, Clerck, of Europe. There is no other species in the genus with which it can be confused.

Metanema brunneilinearia, new species.—Expanse, 33 mm. at greatest width. Head, thorax and abdomen pale yellowish-white, sprinkled with gray scales, thickest on the abdomen. Apical border of abdominal segments destitute of gray scales, and appearing as pale rings to a grayish abdomen. Ground colour of both wings pale yellowish-white, rather profusely sprinkled with gray scales. Primaries with costa produced on basal third, apex acute, thence scarcely sinuous to prominent, acute angle at M3, thence even to rounded anal angle. Intradiscal line pale brunneous, rather narrow, begins on costa more than one-third out from base, extends outwardly to vein R, then turns at right angles and runs, gently sinuous, to inner margin, ending one-third out from base. Extradiscal line sinuous, concolorous with first, but slightly broader, originates on costa one-fourth in from apex, and runs almost parallel with intradiscal line to inner margin. Basal area profusely sprinkled with gray scales, fewer on the costa toward intradiscal line. Median area with a sparse scattering of gray scales; discal spot large, round, dark brown. Outer area heavily overlaid with gray scales, except at outer margin from apex to M3, and thickest in patches between the veins from M1 to anal vein bordering the extradiscal line. On the outer margin between R5 and M1, and M1 and M2, are two dark brunneous crescents with gray and flesh-coloured scales in the concavities. Fringe pale brunneous, checkered with brown at the veins. Secondaries with a single, almost straight pale brunneous line crossing the centre, both areas profusely overlaid with gray scales, less so centrally; discal spot in basal space large, brown, rather faint. Fringe pale brunneous, scarcely checkered with brown. Beneath, ground colour as above, the gray scales distributed as on upper surface, central space of both wings, the apex and veins bright ochreous.

Type: One female in Rutgers College collection.

Habitat: Verdi, Nevada.

Readily distinguished from its congeners by its rough-scaled appearance, suggesting *Eutrapela* rather than the smooth and evenly-clothed species of *Metanema*.

CULICID CHARACTERS.

BY FREDERICK KNAB, WASHINGTON, D. C.

In the June number of the CANADIAN ENTOMOLOGIST Miss Mitchell takes Professor Williston to task for including the Corethrids in the family Culicidæ. In her article there are so many erroneous statements made that, in the interest of truth, they call for correction. Be it clearly understood that I do not accuse Miss Mitchell of falsification. Her errors are in large part due to fragmentary and insufficient knowledge, obtained in part at second hand.

At the very start it must be stated that the idea of separating the Corethrids from the other Culicidæ is by no means a new one. Twice within recent years the family Corethridæ has been proposed by independent workers—Dr. Dyar[1] in this country and Dr. Eysell[2] in Germany—both of them, by the way, "nondipterologists." Dr. Eysell has given a very comprehensive presentation of the case, and more than two years ago brought out, not only all the data offered by Miss Mitchell, but a great many others. Indeed, he outstrips Miss Mitchell in classificatory enterprise, and also elevates the Anophelines to family rank. This paper by Dr Eysell, which I expect to deal with in another place, contains a great deal that is interesting and suggestive. Unfortunately, not all the data given are correct. Both Dr. Eysell and Miss Mitchell develop their ideas from a few familiar forms. Of the great mass of species, some of which contradict their generalizations, they know nothing.

In the following I will only deal with the statements of Miss Mitchell, without, however, attempting to take up every detail. The reader should therefore take note that the statements which remain unchallenged are not necessarily correct in every case.

Miss Mitchell claims that the pupæ of the Corethrids are not active like those of Culicids. The pupa of *Sayomyia* lives submerged, that of the Culicine forms floats at the surface; both become active when alarmed or disturbed, and for activity upon such occasions, the pupa of *Sayomyia* far surpasses anything in the Culicine group. This difference in the two pupæ is largely one of specific gravity. Most Culicine pupæ are so buoyant that they cannot go below the surface without a vigorous

1. H. G. Dyar: Our present knowledge of North American Corethrid larvæ. Proc. Ent. Soc. Wash., VII, 13, 1905.

2. A. Eysell: Sind die "Culiciden" eine Familie? Sbhandl in Bericht, XLIX, Ver. Naturkunde Cassel, 16–24, 1905.

effort, and when this ceases are immediately carried to the top. Dr. Dyar has pointed out to me that the pupæ of *Aëdes atropalpus* and *Stegomyia calopus* can remain below the surface at any depth without effort, and therefore, their specific gravity must be the same as that of the water. In the case of *Stegomyia calopus* this is obviously of great advantage, and even essential, to the preservation of the species. As is well known, this species breeds almost wholly in water in artificial receptacles, in the tropics primarily in the jars of drinking water kept in every house. When water is poured from the jar the pupæ go to the bottom, and remain there until the danger is over. The pupæ of other mosquitoes could not remain below, and would be poured out with the water. With reference to any classification by pupal characters, it must be further stated that the pupæ of *Corethra* and *Eucorethra* are unlike those of *Sayomyia*, and practically like those of Culicines, both in appearance and behaviour. Pupæ essentially similar occur also in the Chironomidæ, and the pupa of at least one species of *Dixa* that I have bred is in every respect like that of a Culicine. In the family Psychodidæ the pupæ are for the most part active. The pupa of an unidentified species of this group, sent to us from Florida, is free swimming and active, and greatly resembles that of a Culicine. In the Psychodid genus *Maruina*, on the contrary, the pupa is inactive, and attached to rocks in moist situations.

As to the eggs of the Corethrids, so far we know only the eggs of *Sayomyia*, and these are suspended in a mass of gelatinous substance. It is quite likely that those of the other genera of Corethrids are not deposited in this way. *Eucorethra* occurs so sparingly that the eggs must be laid singly. The indications are that *Corethra* hibernates in the egg, and if in a gelatinous mass the eggs would hardly be in a suitable condition to withstand freezing. A Culicine which Mr. August Busck has recently discovered on the Isthmus of Panama deposits its eggs in a gelatinous mass. According to Miss Mitchell's classification this mosquito would become a Corethrid ! Turning to the Chironomidæ, we find that although many of the aquatic species deposit their eggs in a gelatinous secretion, there are others that do not. Should these latter be put in a separate family ? Mr. Coquillett's unsatisfactory application, as a primary division, of the mode of egg-laying of the Culicidæ,[3] illustrates with what caution

3. D. W. Coquillett : On the breaking-up of the old genus Culex. Science, N. S., XXIII, 312-314, 1906.

such characters should be used. Such habits are purely adaptive, and may occur in widely-separated groups. Surely no one would think of associating the Sabethine *Joblotia nivipes* with *Culex* and *Culiseta* simply because it lays its eggs in a raft.

It would be unfair to criticize Mr. Thompson, whom Miss Mitchell quotes, before he has himself presented his facts and conclusions. Furthermore, it is impossible to discover from Miss Mitchell's wording just how much is to be credited to Mr. Thompson and how much to his spokesman. This much may be said, however: No safe conclusions as to relationships can be drawn from the examination of a few detached forms. Before formulating any theory of relationships some of the more aberrant Culicine forms, such as *Mansonia*, *Ædeomyia* and *Hæmagogus*, and at least one member of the Sabethine series, should be studied. Perhaps the Sabethines, like the Corethrids, will be found to have four instead of five malpighian tubes. I fancy that the Sabethines will be found to stand nearer the common ancestor than either the Culicines or the Corethrids, but I await further data. In a consideration of the relationships of the Culicidæ with the other families of Nemocera, the Psychodidæ, which seems to have been omitted by Mr. Thompson, should properly play an important part. That *Anopheles* is close to the other Culicine forms, closer than most students are willing to admit, has been the writer's belief for a long time. Miss Mitchell says "Culex may be derived from *Anopheles*." Never! The reverse might be true, for *Anopheles* is by far the more specialized form.

The statement is made that the Corethrid larvæ differ from those of the Culicids by the "place of attachment of antennæ" and "presence of air floats." Neither of these characters holds good for the group, as Miss Mitchell could have ascertained very easily, if material was unavailable, by reference to published descriptions and figures. In *Sayomyia* and *Corethrella* the antennæ are inserted close together at the front of the head; in *Corethra* and *Eucorethra*, however, the antennæ are inserted at the anterior angles of the head, just as in the Culicids. By "air floats" we understand Miss Mitchell to mean the dilations of the tracheal tubes. These reach their greatest development in the larva of *Sayomyia*, where they represent the respiratory system as four large detached air vesicles. In *Corethra* these air vesicles are likewise present, but only form parts of the main tracheal trunks. In the larvæ of *Eucorethra* and *Corethrella* these tracheal dilations are wholly absent; they would be superfluous in

these larvæ which live mostly at the water-surface. Air vesicles of this character occur in various degrees of development in Culicine larvæ. In the larvæ of *Mansonia signifer* and *M. fascipes* they represent a condition very similar to that in *Corethra.*

Miss Mitchell objects to the placing of *Dixa* with the Culicidæ, and one of her reasons is that "the antennæ of the adults are almost bare, and are quite similar in the two sexes." In another place I have already shown that Miss Mitchell's startlingly simple classification of the Culicidæ according to antennal characters[4] resulted from her ignorance of the facts.[5] It may be further pointed out that in the Chironomidæ the same conditions are found. In most of the genera the male antennæ are plumose, but in a few they are similar to those of the female. It does not appear that these conditions have anything to do with the grouping of the genera. The larval characters of *Dixa* enumerated by Miss Mitchell as of family value, cannot be conceded such importance. The segmentation of the thorax is fairly distinct in the Culicid larvæ. As to the prolegs, although I have no material at hand, I am strongly under the impression that their number differs in the different species, if, indeed, they may not be absent altogether. Miss Mitchell indicates them on the first and second abdominal segments. Meinert's figure of the larva of *Dixa* shows them on the fifth, sixth and seventh segments as well.[6] The characteristic proleg on the first thoracic segment of most Chironomidæ is familiar to all students. It is present in most genera of Chironomidæ, but there are some in which it is wholly absent. Are these to be excluded from the family? Moreover, a series of prolegs, similar to those of *Dixa*, occurs in the larva of the Chironomid *Psamathiomyia.* Miss Mitchell describes the pupa *Dixa* as "inactive, floating quietly on the surface," the implication being that they differ markedly from the Culicidæ. In a species which the writer bred the pupæ were just as "inactive" as those of Culicids, and, like them, when disturbed made rapidly for the bottom. In another species which the writer bred the larva leaves the water to pupate, and the pupa remains attached to a blade of grass and motionless, some distance above the water surface.

4. E. G. Mitchell: Validity of the Culicid subfamily Deinoceritinæ. Psyche, XIV, 11–13, 1907.

5. F. Knab: Deinocerites again. Journ. N. Y. Ent. Soc., XV, 121–123, 1907.

6. Fr. Meinert: De encephale Myggelarver, pl. IV, 1886.

In defence of her subfamily Psorophorinæ, Miss Mitchell states that it is based chiefly on characters of the early stages. Herewith I quote her characterization of the subfamily, adding after each item the genera or species that show the same characters. It may be stated that only a few promising forms have been drawn upon for comparison.

"PSOROPHORINÆ."

1. "LARVÆ insectivorous, their mouth-parts fitted for seizing and tearing."—*Psorophora*, *Anopheles Barberi*, *Megarhinus* (including *Ankylorhynchus* and *Toxorhynchites*), *Lutzia*, *Sabethes*, *Lesticocampa*.

2. "MOUTH-BRUSHES a few appressed plates, heavily pectinate along the entire inner margin, and directed obliquely backward beneath head or held out at right angles to it."—The units of the mouth-brushes of *Psorophora* can hardly be termed "a few"—there are fifty or more of them in each brush. In *Megarhinus*, which Miss Mitchell perhaps confused with *Psorophora*, there are from 9–12 units; *Lutzia* holds an intermediate position in this respect. All intergrades occur in the matter of pectination.

3. "MAXILLÆ trapezoidal, with many curved spines, a few short hairs."—*Psorophora*, *Lutzia*, *Limatus*.

4. "LATERAL COMB of mandible a few heavy, immovable spines, their base almost at right angles with top of mandible."—*Psorophora*, *Lutzia*.

5. "MARGINAL COMB of mandible absent."—*Psorophora* (in part!), *Anopheles Barberi*, *Lutzia*, *Megarhinus*, *Lesticocampa*, *Joblotia*.

6. "BITING part very large."—*Psorophora*, *Anopheles Barberi* and other species, *Megarhinus*, *Lutzia*, *Joblotia*, *Limatus*.

7. "ANTENNÆ near middle of sides of head, eyes near posterior margin."—These characters are present in a more or less pronounced degree in many mosquito larvæ.

8. "PUPÆ with anal flaps as broad as long."—This is incorrect. Measurement of a number of specimens shows them to be about one-third longer than broad.

9. "ADULTS with femora and tibiæ bearing many outstanding scales irregularly and thickly arranged around them, never a fringe. Wing-scales narrow."—The outstanding scales of the legs are evanescent or absent in certain species of *Psorophora*. Enough has already been said on the subject of wing-scales.

segments. It was nervous the whole time and appeared to be very much excited, but as the two halves of the body were nearly severed it seemed to get almost frantic, biting and tugging desperately at the joining shreds of viscera until they parted.

The cephalic half of the larva's body was then grasped and worked with the jaws until it became round, and the wasp then made an attempt to carry it off, but without success.

It was then reduced in size, by severing with the jaws into halves again, the insect showing the same frantic movements as before.

The morsel reduced to a convenient size, the mother wasp climbed and reclimbed a nearby corn-plant, until it finally reached a point from which it could safely launch itself into the air. It arose heavily, flew in about eight concentric circles, with the morsel of meat grasped in its legs, then arose obliquely about twenty-five feet, and flew away in a straight south-westerly direction until lost from view.

When first attacking the caterpillar the sting was held in a threatening attitude, but was not used as far as could be seen. The younger larva dropped by the wasp bore a large wound in the second thoracic segment; it was not dead, but limp and helpless.

The predaceous habits of this species are well known, and they have often been recorded as active enemies of many of our injurious insects. Their nests are especially abundant in the corn and cotton fields of Texas, and they doubtless destroy many larvæ which feed exposed on the foliage, and any others which, though internal feeders, may become exposed during their lifetime, through chance or otherwise. Other females of this species of Polistes have been observed to catch boll-worm larvæ exposed as in the foregoing, and strip the integument from their bodies and then chew the whole into a roundish mass of meat and carry them off to their nests. These larvæ, however, were younger.

THE ANNUAL MEETING of the Entomological Society of Ontario will be held in the Biological building at the Ont. Agricultural College, Guelph, on Thursday, Oct. 31, and Friday, Nov. 1. The sessions will begin on the afternoon of the former day, and be continued during the day following. The Wellington Field Naturalists' Club will hold its annual meeting on Saturday, Nov. 2, and hopes that all in attendance will remain over that day. Popular addresses under the auspices of both Societies will be given on the Thursday and Friday evenings. Members intending to be present will please notify the Secretary at their earliest convenience.

THE BOSTON MEETING OF THE ENTOMOLOGICAL SOCIETY OF AMERICA.

Taking advantage of a time and place when many entomologists and other zoologists would be gathered together to attend the Seventh International Zoological Congress, and to supplement for those interested in entomology, the very interesting session of that Congress, a meeting of the Entomological Society of America was held in Boston during the week commencing August 19th.

On Tuesday afternoon, August 20, about 50 members of the Society, as guests of Mr. A. H. Kirkland, were taken in special cars to Saugus, where they were shown the details of the campaign against the Gypsy and Brown-tail moths. The operations directed towards the control of these pests by means of the importation of parasites were of especial interest.

On the evening of the 22nd a meeting was held in the room of the Boston Society of Natural History, at which the following 53 persons were in attendance:

Members: Prof. John Barlow, Kingston, R. I.; Rev. Prof. C. J. S. Bethune, Guelph, Ont.; Mr. William Beutenmuller, N. Y. City; Mr. C. V. Blackburn, Stoneham, Mass.; Mr. J. C. Bradley, Ithaca, N. Y.; Mr. A. F. Burgess, Boston; Mr. Erich Daecke, Philadelphia, Pa.; Mr. N. S. Easton, Fall River, Mass.; Mr. J. H. Emerton, Boston; Mr. G. P. Englehardt, Brooklyn, N. Y.; Prof. C. H. Fernald and Prof. H. T. Fernald, Amherst, Mass.; Mr. W. L. W. Fielde, Boston; Mr. C. A. Frost, South Framingham, Mass.; Mr. F. Haimbach, Philadelphia, Pa.; Dr. J. Headlee, Durham, N. H.; Mr. E. F. Hitchings, Waterville, Me.; Dr. W. J. Holland, Pittsburg, Pa.; Mr. C. W. Johnson, Boston; Prof. V. T. Kellogg, Palo Alto, Cal.; Prof. Trevor Kincaid, Seattle, Wash.; Mr. F. E. Lutz, Cold Spring Harbor, N. Y.; Mr. H. H. Lyman, Montreal; Mr. B. P. Mann and Mr. C. T. Marlatt, Washington, D. C.; Prof. A. P. Morse, Wellesley, Mass.; Mr. H. H. Newcomb, Boston; Prof. Herbert Osborn, Columbus, O.: Prof. R. C. Osburn, New York; Miss Edith M. Patch, Orono, Me.; Dr. H. M. Russell, Winchendon, Mass.; Prof. E. D. Sanderson, Durham, N. H.; Dr. Henry Skinner, Philadelphia, Pa; Prof. J. B. Smith, New Brunswick, N. J.. Mr. F. M. Webster, Washington; Dr. Wm. M. Wheeler, New York.

Visitors: Dr. G. Horvath, Buda-Pesth; Prof. N. J. Kusnezov, St. Petersburg, Russia; Prof. G. A. Severin, Bruxelles; Dr. H. Heymons,

Berlin ; Mr. F. Bates; Prof. and Mrs. T. D. A. Cockerell, Boulder, Colo.; Mr. E. C. Cotton, Knoxville, Tenn.; Mr. W. F. Fiske, Washington ; Mr. J. Arthur Harris, St. Louis, Mo.; Mr. G. V. Pinder, New York ; Mr. L. R. Reynolds, Boston ; Mr. A. C. Sampson, Sharon, Mass.; Mr. L. W. Swett, Bedford, Mass.; Mr. A. G. Weeks, Boston ; Mr. R. K. Wolcott, Lincoln, Neb.; Mr. Chas. Zeleny, Bloomington, Ind.

The following were in Boston during the meetings : Dr. R. Blanchard, Paris, France, Mr. R. H. Johnson, Cheney, Wash.; Dr. H. G. Dyar, Washington, D. C.; Mr. J. Martin, New York State ; Dr. L. O. Howard, Washington, D. C-; Mr. J. E. Bates, Whitman, Mass.; Mr. E. H. Forbush, Malden, Mass.; Mr. H. C. Weeks, Gilman, N. Y.; Prof. A. F. Conradi, College Station, Texas ; Mr. A. H. Kirkland, Boston ; Mr. S. Henshaw, Cambridge, Mass.; E. A. Goeldi, Para, Brazil ; Mr. W. Wirtner, Penn. Station, Pa.

In the absence of Prof. Comstock, the President, and Dr. Fletcher, the First Vice-President, Dr. Skinner, the Second Vice-President, took the chair. In opening the session, he welcomed, on behalf of the Society, the foreign and other visitors who were present. Like all new movements, he said, the new Society had at first met with some opposition on the part of those who failed to see the advantages to be derived from it. But only by trying can we hope to ascertain its possibilities for good. He believed the Society was an expression of the steadily increasing interest in entomology, and felt that the number who had enrolled as members, now over 400, and the eagerness with which membership had been sought, was a very convincing proof of the demand for the organization. He believed firmly in its utility, and wished it great success and long continuance.

The Secretary announced that the following persons had been elected Honorary Fellows of the Society : Ezra Townsend Cresson, Philadelphia ; Samuel Hubbard Scudder, Cambridge ; William Harris Ashmead, Washington ; William Henry Edwards, Coalburg, W. Va.; Philip Reese Uhler, Baltimore ; Henry Christopher McCook and Henry Ulke, Philadelphia.

The Secretary further announced that the following had been elected Fellows of the Entomological Society of America : John Merton Aldrich, Moscow, Idaho ; Wm. Beutenmuller, New York ; Philip Powell Calvert, Philadelphia ; Daniel William Coquillett and Harrison Gray Dyar,

Washington; Jas. H. Emerton, Boston; Charles Henry Fernald, Amherst, Mass.; Stephen Alfred Forbes, Urbana, Ill.; Samuel Henshaw, Cambridge, Mass.; Andrew Delmar Hopkins and Leland Ossian Howard, Washington; Vernon Lyman Kellogg, Palo Alto, Cal.; Henry H. Lyman, Montreal; James George Needham, Ithaca; William Saunders, Ottawa, and Eugene A. Schwarz, Washington.

The original Fellows, elected at the first meeting, which was held in New York in December last, are: John Henry Comstock, Ithaca; James Fletcher, Ottawa; Henry Skinner, Philadelphia; Charles J. S. Bethune, Guelph; Charles Willison Johnson, Boston; Herbert Osborn, Columbus, Ohio; John B. Smith, New Brunswick, N. J.; Francis Marion Webster, Washington; William Morton Wheeler, New York.

The whole number of Fellows is thus 25, which is the limit laid down by the Executive Committee. Prof. Osborn, on behalf of the Publication Committee, announced that it did not seem desirable to take over any existing journal, to publish anything that would occupy the field of any existing journal, or to make any of the current periodicals the official organ of the Society. It might, however, prove desirable to undertake sooner or later a dignified series of publications in the form of "Annals" or "Memoirs," which would be distinctly creditable to American entomology.

The President invited the foreign entomologists who were present to address the meeting, calling upon Dr. Horvath, of Buda-Pesth; Prof. Kusnezov, St. Petersburg; Prof. Heymons, Berlin, and Prof. Severin, Bruxelles, each of whom responded with a few words of kindly greeting to the new Society.

Dr. Holland, who had been asked to bear the greetings of the Society to Dr. Scudder, gave an account of his interview with the venerated invalid, and told of the pleasure which his message of love and respect had afforded. Dr. Scudder desired him to "thank the Society from the fulness of his heart for having remembered an old man, now almost a shadow of his former self."

Dr. Bethune expressed the thanks of the Society to their entertainers in Boston, and especially the Cambridge Entomological Club.

Dr. J. B. Smith proposed that the thanks of the meeting should be given to Mr. Kirkland for the delightful opportunity he had afforded them for observing the experiments now being carried on at Saugus. The motion was very heartily concurred in.

Dr. J. B. Smith read a paper entitled "Some Unrecognized Sexual Characters of Noctuidæ." The males of many Noctuids have characteristic hair-tufts and hair pencils on the legs, and these reach their extreme development in the Deltoid series. Many other Noctuids have pencils, brushes and scale-tufts concealed in abdominal cavities, and of these little or nothing has heretofore been known. A few of the principal forms were shown on slides.

Mr. J. Chester Bradley read "A case of gregarious sleeping habits among Aculeate Hymenoptera." In the San Joaquin Valley in California a large number of sleeping Hymenoptera were observed gathered into clusters. But each cluster contained only a single species, and there were nine species represented in all.

Prof. F. M. Webster spoke on "Parasitism of Toxoptera." Drawings were exhibited, showing the movements of the larva when parasitizing, which caused the body of the host to assume a characteristic globose shape.

Mr. Bradley read "The Evolution of the Wings of Evaniidæ." The wings of this family portray in a remarkable manner the progress of evolution. From a relatively complex venation we find gradual steps through various degrees of atrophy, resulting in the almost complete loss of venation. The paper was discussed by Dr. Holland and Prof. Kellogg.

The meeting then adjourned to a very enjoyable smoker in the Grundman Studios, at which the Society and its visitors were the guests of the Cambridge Entomological Club.—J. CHESTER BRADLEY, Secretary-Treasurer.

JAMAICAN HEMIPTERA.—In the Bulletin of the Buffalo Society of Natural Sciences (Vol. viii, No. 5, 1907, pp. 1–77), Mr. E. P. Van Duzee gives a report on a collection of Hemiptera that he made in Jamaica during a short visit in March and April, 1906. Though climatic and other difficulties were great, heavy rains and tropical heat alternating in rendering out-door work at times impossible, he was able to procure specimens of 236 species, of which 85 are new to science, and among them are representatives of no less than ten new genera; a large proportion of these forms are described in this paper. The Capsidæ collected were submitted to Dr. O. M. Reuter, of Helsingfors, who has described as new seven genera, 29 species and two varieties from the material submitted to him. Students of the order will welcome this valuable contribution to its literature, in which are to be found many critical notes on species already known, as well as the descriptions of new forms. The paper is rendered all the more interesting and acceptable by the excellent portrait of the author which forms its frontispiece.

Mailed October 5th, 1907.

A FOSSIL BUTTERFLY—CHLORIPPE WILMATTAE, CKLL.

The Canadian Entomologist.

VOL. XXXIX. LONDON, NOVEMBER, 1907. No. 11.

A FOSSIL BUTTERFLY OF THE GENUS CHLORIPPE.

BY T. D. A. COCKERELL, UNIVERSITY OF COLORADO.

Among the interesting specimens found in the miocene shales of Florissant, Colorado, is a well-preserved butterfly, collected by my wife. It shows the head and thorax, one antenna, and the anterior wings, all well preserved. The study of it has raised some questions as to the evolution of the markings and wing-form in *Chlorippe* and its allies, and I venture to hope that a statement of these may produce some fruitful discussion.

Chlorippe Wilmattæ, n. sp.

Expanse, 64 mm.; length of anterior wing, 30 mm.; antennæ about 13 mm., gradually broadening apically, the club not at all abrupt; about 4 mm. may be considered to be club, but it is hard to say where it begins. Palpi well developed, apparently as in *Chlorippe*. Thorax robust, dark. Wings with the outline about as in *C. alicia*, ♂, but the apical point between the radials is sharper and longer, being quite suggestive of that part in *Vanessa*, and exactly agreeing with the same structure in the South American *Chlorippe sultana* ♂; wing as preserved pale sepia brown, with whitish spots, these latter corresponding to those in *Chlorippe*, in a general way, but differing in the arrangement. In the apical field the spots are small and round; the three outer ones, instead of forming the corners of a triangle, are arranged in a line, which is slightly curved outwards, and parallel with the outer margin. On the other hand, the three inner ones, which in *Chlorippe* form a curved or oblique line or band, are so arranged that the two lower are close together, one above the other, while the third or upper is far basad, the interval between the upper and middle one being about the same as that between the middle inner and corresponding outer. The four large spots in the median interspaces are all very distinct, 2 mm. or over in diameter; none of them are ocelli. In modern *Chlorippe* the upper inner one is usually quite small, but in the fossil it is large like the lower, and is so placed that a line drawn through the two inner ones points almost accurately to the apex of the wing. Of the spots between the median and submedian veins, both are somewhat diffused, though distinct, and the outer is

placed directly beneath the lower outer one of the median interspaces, instead of basad of it as in modern *Chloripe*. The inner is also shifted more apicad, forming a large patch beneath the inner lower one of the median interspaces. There is no pale marginal line or band. The venation agrees with that of *Chloripe*, with the same open cell. The cell is about 16 mm. long, thus reaching beyond the middle of the wing.

Florissant, Station 21 (hill south of the sawmill), July, 1907 (W. P. Cockerell).

With regard to the wing-form, it is noteworthy that it resembles more that of *Vanessa* than that of the modern North American *Chloripe*, but it agrees well with the South American *C. sultana*, Foetterle. The markings, however, are much nearer to those of the North American species. Modern *Chloripe* shows a noteworthy sexual difference in wing-form, the males possibly approximating to the older type, if we are justified in regarding the fossil as a representative of such.

Since the North and South American species of *Chloripe* differ very strongly, we are naturally led to ask which is on the whole the older, and where did the genus originate? The fossil certainly is not decisive upon this point, and I do not pretend to offer a definite opinion. Assuming, however, that such a species as *C. sultana* represents an early type of *Chloripe*, certain things follow in an interesting manner. Taking such a species as *Vanessa j-album*, we find that the markings of the anterior wings take the form of three oblique, parallel, more or less broken bands. These bands may be traced in many Nymphalidæ; thus, in *Junonia cœnia* the middle one is especially prominent. Now, in *Chloripe sultana*, or rather in the variety or allied species, *favorita*, Foetterle, we find these bands all very distinctly represented by rows of white spots, the first and third by two each, the middle one by five. If this is a primitive condition, what has happened in the evolution of the North American species? The first or apical band remains unaltered, except that the lower spot is often an ocellus. The second is broken by the shifting of the three upper spots to form somewhat of a crescent, while the two lower spots are no longer oblique, but one above the other. Moreover, a new spot has appeared, just above the first of the two lower, and the three form a straight line parallel with the margin. The lowermost is usually an ocellus. The inner band is modified by the intrusion of the fulvous base of the wing, and has some additional spots.

In the fossil we find :

(1) The first band is parallel with the margin, not oblique, thus differing from the living forms.

(2) The second band has the uppermost spot shifted even more out of place than in the N. American species ; but the third spot is nearly over the fourth, so that the continuity of the band is fairly evident. The whole band, however, is not nearly so oblique as in *C. sultana*.

(3) The inner band consists of three spots, the middle large one being quite absent in *C. sultana*, but present in the N. American species.

(4) In the recent N. American species the small spot in the middle of the wing looks like part of the innermost band ; it is wholly absent in *C. sultana*. In *C. Wilmattæ*, however, it is very large, and entirely out of the line of the inner band ; appearing, on any theory of the derivation of the spots from three bands, as an extra and unexplained character. When, however, we turn to such a species as *Basilarchia Lorquini*, we find this spot coming in quite naturally as part of the great white transverse band ; and the breaking of this band to form the median oblique band is seen in *Heterochroa Californica*.

Among the fossil butterflies known from Florissant, *Chloríppe Wilmattæ* is most like *Lithopsyche styx*, Scudder. I compared it carefully with the type of the latter, in the Museum of Comparative Zoology, and they are evidently not closely allied. The markings of the *Lithopsyche* differ in many details.

THE COLLETIDÆ OF SOUTHERN MAINE.

BY JOHN H. LOVELL, WALDOBORO, MAINE.

Colletes compactus, Cr.

1868—Colletes compacta, Cr. ♀ ♂, Proc. Bost. Soc. Nat. Hist., 12:166.

1879—Colletes compacta, Patton. ♀ ♂, Proc. Bost. Soc. Nat. Hist., 20:142.

Female specimens taken on Solidago Sept. 7 to 18, and on Aster puniceus, Sept. 12. This species and C. armatus and C. americanus have been collected only late in August or in September.

Colletes inaequalis, Say.

1837—Colletes inaequalis, Say. ♀ ♂, Bost. Jour. Nat. Hist., 1:391.

1859—Colletes inaequalis, Leconte, ed. of Say's Writ., 2:770.

1868—Colletes propinqua, Cr. ♀ ♂, Proc. Bost. Soc. Nat. Hist., 12:165.

1879—Colletes inaequalis, Patton. Proc. Bost. Soc. Nat. Hist., 20:142.

One female specimen on Salix, May 7, 1905.

Colletes armatus, Patton.

1868—Colletes inaequalis, Cr. (not Say). ♀, Pr. Bost. Soc. N. H., 12:166.

1879—Colletes armata, Patton. ♀ ♂, Proc. Bost. Soc. Nat. Hist., 20:143.

1891—Colletes spinosa, Robt. ♀ ♂, Trans. Am. Ent. Soc., 18:60.

Female taken on Solidago, Aug. 25 to Sept. 3; male on Solidago, Aug. 20 to 28.

Colletes americanus, Cr.

1868—Colletes americana, Cr. ♀ ♂, Proc. Bost. Soc. Nat. Hist., 12:167.

1879—Colletes americana, Patton. Proc. Bost. Soc. Nat. Hist., 20:142.

Female on Aster puniceus, Sept. 12; male on Solidago, Aug. 13, to 28, and Eupatorium perfoliatum, Aug. 24. A widely-distributed species. Reported also from Illinois and New Mexico.

Mr. Myron H. Swenk has kindly examined specimens of the species enumerated in this paper and furnished the following description:

Colletes mesocopus, Swenk, n. sp.—♀. Length, 8–9½ mm. Clypeus convex, shining, coarsely and irregularly striato-punctate. Front dull, crowded with coarse shallow punctures and thinly-clothed with short gray hair. Vertex closely double punctured, bare on sides, medially and the occiput with erect, grayish hair. Cheeks with sparse, coarse, but weak, punctures and thin ochreous-gray hair, except on extreme sides above, where it is thin and black. Malar space about one-fourth as long as broad. Antennæ short, wholly black, joint 3 decidedly exceeding 4, almost = 4 + 5. Prothoracic spine short, sharp and distinct. Mesothorax with small, sparse, rather weak punctures, coarser on posterior margin, the disk with a large polished impunctate area. Scutellum

coarsely closely punctured posteriorly, anteriorly sparsely so. Postscutellum finely roughened. Superior face of metathorax well defined, divided into subquadrate, shining, regular pits, the enclosure funnel-shaped, polished, the areas surrounding it opaque and weakly, irregularly rugose. Mesopleura punctured similarly to, but coarser than the dorsal surface, the tubercles impunctate and polished. Pubescence of thorax thin, erect, dull gray, strongly tinged with ochreous on dorsum. Wings darkened, the nervures and stigma black. Tegulæ black. Legs rather stout, black, entirely clothed with stiff yellowish-white hair, very dense on inner surface of legs, the tarsal tufts reddish. Claws rufous, medially toothed. Tibial spurs very short, dark, quite simple. Anterior coxæ with no indication of a spine. Abdomen short, oval, polished, the basal segment subimpunctate, following ones very finely, indistinctly punctured. Apical margins of segments 1–4 feebly depressed, of 1–5 with broad, loose, white fasciæ. Basal segment with sparse, long, white hair, the disks of 2–6 with erect black bristles, very long and abundant on 3–5. Ventral segments 1 and 2 with a dense, erect, polleniferous scopa, concolorous with that of posterior legs, 3 and 4 with similar dense apical fringes, 5 and 6 with black bristles.

♂. Length, 8 mm. Clypeus covered with long, dense ochreous-gray hair, contrasting with the pure gray hair on rest of face, no black hair on cheeks; antennæ long, joint 3 = 4, following joints one-third longer than wide; pubescence of thorax long and abundant, pure dull gray; basal abdominal segment sparsely, weakly punctured; segment 2 with long white hair, like on 1; 3–6 with black bristles, no ventral scopa; claws subapically cleft; no definite prothoracic spine. Otherwise essentially like the ♀.

Types.—Waldoboro, Maine, July 9, 1905, No. 3721, ♀; July 11, 1907, on Kalmia angustifolia, No. 4235, ♂. J. H. Lovell, collector.

Paratypes.—Waldoboro, Maine, July 9, 1905, No. 3724; July 5 on Rosa humilis, No. 1931, ♀; July, 1904, No. 2697, ♀.

This species is very distinct. Its nearest ally is *C. hyalinus*, Provancher, but it differs from that species in the punctuation of the mesothorax and other details. Mr. Lovell informs me that this bee is a frequent visitor of Kalmia angustifolia, but only rarely visits the rose.

NEW COCCIDÆ FROM CALIFORNIA.

BY O. E. BREMNER, SAN FRANCISCO, CAL.

Aspidiotus densifloræ, n. sp.—(Fig. 20.) Puparium of female snow-white in colour, varying in form from round to sub-oval, according to position on the leaf, and slightly convex. Exuviæ situated a little to one side of the centre. First larval skin light yellow, second nearly white. Length, 1½ to 2 mm.

Male puparium much smaller than the female (1 mm.), snow-white in colour and oval in form.

Length of scale on slide, 1.3 mm. Two pair of well-developed lobes notched on the outer margin, both are similar in form, the median being half larger than the second pair. Median lobes thickened on inner edges with a chitinous extension to and surrounding the anal orifice. Plates prominent, extending to the end of lobes. A pair of trifurcate plates between median lobes. A pair of four-toothed furcate plates between median and lateral lobes. In the depression after the lateral lobes are three pairs of large plates with a number of teeth, the third is largest, and usually has six teeth. Very few spines; one at the base of each lobe, another shortly after the last plate, and one quite distant along the margin. Dorsal pores prominent. Five groups of circumgenital gland orifices; median one sometimes lacking; anterior laterals, 5 to 6; posterior laterals, 3 to 5. Anal orifice rather large and remote from the margin.

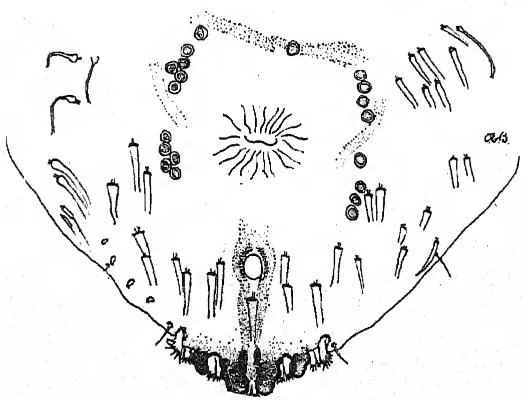


FIG. 20.—Aspidiotus densifloræ.

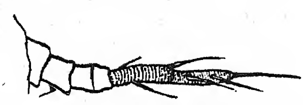


FIG. 21.—Antenna of larva of Asp. densifloræ.

Larvæ pale yellow. Antennæ 5-jointed; 5th segment longer than all the others combined, ringed with a stout median bristle and three more at the tip; joint 2 equal to 3+4, 3 and four equal. Formula

5, 2, 1 (3, 4). (Fig. 21.) A pair of well-developed lobes notched on the outer side; two very long hairs and two short spines between the lobes.

Collected by the author on the under side of leaves of *Quercus densiflora* in Mendocino County, California.

Aspidiotus yulupæ, n. sp.—(Fig. 22.) Puparium of female round and quite convex. Black in colour, but often appearing gray when partly, or in some cases completely, covered by the epidermal tissues. Exuviæ are in the centre of the scale, and are pink in colour, with a grayish central spot. Length of largest specimens, 1 mm. The males are not distinguishable from the females, having the same colour and form.

Length of scale on slide, .64 mm.; width, .46 mm. One pair of

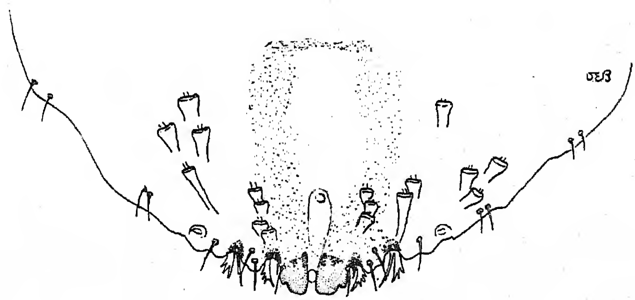


FIG. 22.—Aspidiotus yulupæ.

well-developed lobes, with a deep notch on the outer side; second and third pairs of lobes rudimental, and showing no indications of chitin after boiling in K. O. H.; second with a groove on the outer side, and third with a groove in centre. Very few plates, a short curved one and a large one with four teeth between the first and second lobes; a long plate with branched end and a stout one with three teeth between the second and third lobes. Marginal spines quite prominent. One at the outer base of first lobe; one at the centre and one at the base, just below the notch of second lobe; one at centre, and just below the groove of the third lobe; one pair of spines near the middle of the segment, and one pair near the cephalic margin. Dorsal pores prominent, but not numerous. There are no groups of circumgenital gland orifices; anal orifice small and remote from the margin.

Collected by the author on *Quercus lobata*, Yulupa Valley, Sonoma County, California.

Odonaspis graminis, n. sp.—(Fig. 23.) This coccid is found on the roots of grass, and is very easily detached from the host plant. It has much the appearance of a clam, ranging in form from mytiliform to round, and is dirty-white in colour, and 1 to 1½ mm. in size. The exuvia is at one side, and at the anterior extremity is glossy straw-coloured. The

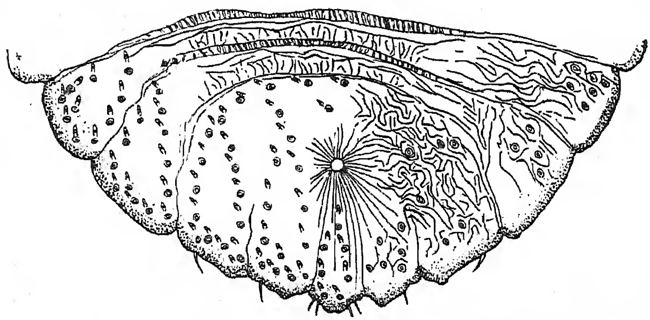


FIG. 23.—Odonaspis graminis.

ventral scale is nearly as well developed as the dorsal, and has what appears to be the ventral half of the exuvia at the anterior end. The scales may be pried apart much the same as you would open a clam.

The adult female is oval in form and yellow in colour. The segments are distinct and chitinized at the margins with groups of dorsal pores. There is a group of glands around each of the openings of the anterior spiracles. The pygidium is broad and strongly chitinized. The lobes are obsolete, and are represented by points in the centre of the suppressed segments. The rudimentary median lobe is more pronounced than the others, with a groove in the centre. There are two spines at each side of the median segment and one on each of the second and third suppressed segments. There are no groups of circumgenital gland orifices. The dorsal pores are numerous and regularly placed, a double line at the margin and a single line on each side of the segments. The anal aperture is situated at some distance from the extremity.

Habitat—This species was collected by E. M. Ehrhorn on the roots of grass from the Presidio Hills, San Francisco, California.

NOTES ON THE BREPHIDÆ.

BY JOHN B. SMITH, SC. D., NEW BRUNSWICK, N. J.

The family *Brephidæ* as it stands in our lists contains only five species in two genera, *Brephos*, Ochs., and *Leucobrephos*, Grt., the latter described by Mr. Grote in the CAN. ENT., XV, p. 55, 1883, although first used, without description, in the Buff. Bull., II, 53, nine years previously.

Of the species referred to *Brephos*, only one, *infans*, Moeschl., is known in collections; the two species, *melanis* and *californicus*, described by Boisduval in his Lepidoptera of California in the Ann. Soc. Ent. Belg., XII, 1869, have remained unknown up to this time. Mr. Grote (l. c.) suggests that they are really Arctians, and I am inclined to agree with him. I have tried to identify the species with specimens of *Leptarctia*, but my series is not sufficient to quite make it. In the hope that some of the readers of the CAN. ENT. may be better off in that genus, I present the following copies of the original descriptions, freely translated :

BREPHOS CALIFORNICUS, Bdv.

Primaries fusco-cinerous, with three obsolete white maculæ; secondaries fulvous, with two black bands.

This has the appearance of *notha* and *puella*, but is smaller. The primaries above are of a grayish-black, with three little white spots, of which one is on the costa ; another, much less pronounced, is toward the apex, and the third forms a small lunule above the internal angle. The secondaries are yellow, a little fulvous, crossed toward the middle by a black band which is constricted and interrupted ; and outwardly the border is larger, black, with the fringe yellow. Beneath all the wings are yellow, with two common black bands. The female does not differ from the male except that the antennæ are more slender.

Found in the spring in the clearings in woods.

BREPHOS MELANIS, Bdv.

Primaries grayish-fuscous, with two obsolete white marks; secondaries black, immaculate.

Size and form of the preceding. The primaries are of a grayish-black, with two spots of dirty white, of which one is on the costa and the other, a little smaller, toward the internal angle. The secondaries and the fringe are completely black. Beneath, the primaries are traversed by a broad yellow band. We have seen only males.

Lives in the woods.

The particular reason which induced me to look up this matter is that I found among specimens sent me for determination by my good friend and the prince of good fellows, Dr. James Fletcher, a specimen of what appeared to be an *Annaphila*, which fitted nowhere, and was sufficiently odd in appearance to induce me to examine it more closely. To my surprise I found it a Brephid, utterly unlike any other of our species, and because there is only one, and I know no other like it, I call it

BREPHOS FLETCHERI, n. sp.

Head and body totally black. Primaries sooty-black, with a vague trace of pale marginal and submarginal bands. The fringe is gray, with a black interline. Secondaries yellow, with a rather narrow black border, the inner margin of which is irregular, and a basal black area which extends from one-third the costal margin diagonally to the inner margin just above the anal angle, and does not quite join the outer black border. Beneath yellow; primaries with blackish marginal borders and an oblique black median fascia; secondaries with a minute black discal mark, a subbasal narrow blackish band and a narrow blackish terminal band much like that of upper side. Legs black, tarsi white-ringed at the joints; hair of under side grayish.

Expands: 1 inch = 25 mm.

Habitat: Coldstream, British Columbia, March 23; taken by Mr. E. M. Anderson. Numbered 1 and 13.

The interesting notes on the distribution of *Leucobrephos Middendorfi* by Dr. Fletcher in the Ottawa Naturalist, induced me to inquire why *brephoides*, Wlk., was no longer found, though both Zeller and Grote had obtained (and redescribed) the species.

Dr. Fletcher's reference to the species was based on my determination, and my determination was based on Moeschler's work and his record in the Stett. Ent. Zeit., 1883, 117. I was in correspondence with Mr. Moeschler at that time, and he was good enough to send me an example of the Labrador material for study. Before I returned it I secured an excellent photograph, which for many years was the only representative of the species in my collection. Through Dr. Fletcher I finally secured an example of Mr. Criddle's capture from Aweme, and that might easily have been the original of the photograph made from Moeschler's example. It was *Middendorfi*, Moeschler, without doubt; but was it *Middendorfi*, Menetries? Moeschler in his work speaks positively enough: "Of this

interesting and in collections yet very rare species I received a clean ♀ from southern Labrador." But he makes no comparisons and no reference to Zeller's species described 20 years before in the same journal and figured.

I determined to make the comparison myself, and did so in the Academy of Natural Sciences at Philadelphia, where they have a copy of "Schrenk's Reise." Sure enough, as I had begun to fear, *Middendorfi*, Men., was not Moeschler's species, but a closely-allied representative; and on going further it became equally certain that all these references to *Middendorfi* really belonged to *brephoides*, Wlk., which is the only species thus far known to inhabit North America.

I am sorry, not because I made a blunder, for it is not the first one I have made, but because I have misled Dr. Fletcher and made him write *Middendorfi* instead of *brephoides*.

OUR SPECIES OF NYCTOBIA, HULST.

BY RICHARD F. PEARSALL, BROOKLYN, N. Y.

Much confusion exists as to the status of the species, as now they are listed under this genus. In an endeavour to ascertain their true relationship, I have been gathering for some years a series which might be truly representative. The past year (1906) I captured a great number of forms in the Catskill Mts. from May 4 to 16, and have before me of both sexes, about evenly divided, 156 good examples. Beside these I have a small series taken by myself in Bronx Park, N. Y. Co., and another series of 16 from Lackawanna Co., Penn., through the kindness of Mr. Rothke, and one specimen taken on Long Island by Mr. Geo. Englehart, of the Children's Museum, Bedford Park, in this city. The group from the Catskills and those from Bronx Park all constitute one species, though their variations are endless, and come under the name *limitaria*, Walk. The other series from Pennsylvania and the single specimen from Long Island, are unquestionably the *anguilineata*, Grote, and are markedly different in arrangement of colour lines, presenting a bluish-black cast, not the brown and pale gray of *limitaria* and its varieties, and the texture of the wings is heavier, with apices more produced. They vary somewhat among themselves, but preserve their distinctive pattern, so that once known they are easily picked out among any number of the other species. The vertex and front are generally a chalky-white, with a black line crossing below

antennæ, as mentioned by Grote, and this prevails in all but one of my specimens, not dusky or dark brown, mixed with white, as in *limitaria*. When fresh they are washed and streaked with green, but not in the fantastic fashion of *limitaria*. From this latter a number of extreme forms may be selected, but they grade into one another in a large series. In his description of *L. vernata* (Mono., page 183), Dr. Packard speaks of the snow-white front with black hair-line below antennæ, clearly indicating by this and other similarities that he was describing a specimen of *anguilineata*. Yet he figures (Plate 8, fig. 13) a form of *limitaria*. Under his reference to *anguilineata* (page 184), which is very brief, he says "specimens may yet be found connecting *L. vernata* with this." To my mind there is no doubt they are the same, the older name of Grote taking precedence. The type of *anguilineata* came, I think, from Pennsylvania, and while single examples have been taken elsewhere, like the Massachusetts specimen, and my own from Long Island, its home centre seems to lie in the mountains of Pennsylvania. In the spring of 1906 I forwarded to Mr. Prout for comparison with Walker's types in the British Museum, a small lot of *limitaria*. He writes of them thus: "*Lobophorata*, Walk.; *fusifasciata*, Walk., and *longipennis*, Walk. (all in coll. of Brit. Mus.), are clearly forms of the variable species you call *limitaria*, Walk., and I shall accept your synonymy." I find also that Prof. Grote, writing in CAN. ENT., Vol. 8, p. 152, long ago reached the same conclusion, but at that time overlooked the older name of *limitaria*.

With abundant material before me, I therefore conclude that the species of *Nyctobia* should be listed as follows:

limitaria, Walk.
  = lobophorata, Walk.
  = fusifasciata, Walk.
  = longipennis, Walk.
  = Cystiopteryx viridata, Grote (Hulst in error).
anguilineata, Grote.
  = vernata, Pack.
nigroangulata, Strecker.
viridata, Packard.
  = Agra eborata, Hulst (in error).

A word as to *viridata*, Pack. This is the species upon which Dr. Hulst founded his genus *Agia*, making it his type. He says in closing: "Very close to *Nyctobia*, differing mostly in the presence of the

frenulum." Since the frenulum is also present in *Nyctobia*, there remains no difference whatever, except in its longer palpi, and this does not, in my opinion, warrant generic separation. In a recent List of Brit. Col. Lepidoptera (Dept. of Agric., B. C., 1906), Rev. G. W. Taylor places this species in the genus Trichopteryx, Hüb., but this is an error. The type of *Trichopteryx* is *carpinata*, Bork. (*lobulata*, Hüb.), in which vein 8 of hind wings is widely separate from cell, but joined to it by a cross bar at end.* In our species vein 8 anastomoses with cell its entire length.

A NEW PLATÆA, HER.-SCH.

BY RICHARD F. PEARSALL, BBOOKLYN, N. Y.

A recent paper on this genus by Rev. Geo. W. Taylor, defines correctly the status of our species, as I believe, and renders unnecessary the publication of a paper I had partially prepared, except as to the addition of the species described herein.

Platæa lessaria, n. sp.

Expanse, 22 mm. Head, palpi, antennæ, thorax and fore wings a clear pale lavender, the latter with black scales, basally clustered, elsewhere scattering, strigate with brown along costa. The central band is composed of dark brown, nearly black, scales along outline, fading centrally to the ground colour, which surrounds the linear dark brown discal spot. Its inner margin starts from costa one-fourth out, runs outward across cell beyond the base of vein 2, then turns sharply backward and downward to a point half way between vein 1 and cell. Outer margin leaves costa two-thirds out, makes a short curve inward across it, then forms a short broad angle by an outward turn to vein 6, and with a long inward curve reaches a point half way between veins 1 and 2, opposite but a little lower than the inner line; bottom truncate. Around this irregular figure the ground colour is clearer, almost white, gradually darkening submarginally into a broad pale brown line, its outer margin darkest and sharply defined, commencing about one mm. from apex, reaching the anal angle in two broad inward curves, the upper shortest, its course parallel with the outer margin of central figure. Narrow submarginal space darkest toward margin. Marginal line rather broad, dark brown. A white line at base of fringe, which is outwardly checkered

*See Meyrick, Brit. Lep., page 180, 1895.

brown and white. Hind wings paler, with a yellowish cast, and a few scattered brown scales. Discal dots small, faint. No other markings. Marginal line faint brown; fringe as ground colour, not checkered. Beneath soiled white, with numerous brown scales, the fore wings somewhat yellowish, and having lavender scales distributed apically. Discal dots distinct on all wings. The central figure faintly reproduced, as is also the subterminal line, which is extended across hind wings in much the same pattern. Abdomen and legs slender, soiled white.

Type, one ♂ taken at San Diego, Calif., July 20, 1906, through my friend, Mr. H. W. Marsden.

The smallest of our species, and with the central figure well defined, while preserving the general outline of those of its congeners.

THE ARANEINA OF SANTA CLARA COUNTY, CALIFORNIA.

BY KARL R. COOLIDGE, PALO ALTO, CALIF.

The fact that so few local lists of Araneina have been published, and their distribution is so little known, except by those who have access to large collections and libraries, has induced the writer to publish the following list. That it is very incomplete, I fully realize, as I have many undetermined species in my collection, and many more will be found by careful collecting. To make the list as complete as possible, I have included a number of species which I have not taken myself, but which have been recorded by Banks* or are in the Stanford University collection. As the Santa Clara Valley Entomological Society is undertaking a study of the fauna of the salt marshes of San Francisco Bay, I have marked with a dagger those species which have been found there. An asterisk indicates type locality.

THERAPHOSIDÆ.

Actinoxia versicolor, Simon. Black Mt. Rather common.†
Atypoides Riversi, Cambridge. Rare.
" Californica, Banks. Black Mt. October.*
Eurypelma Californica, Banks.

DRASSIDÆ.

Poecilochroa pacifica, Banks.*

CLUBIONIDÆ.

Gravenna Californica. May.
Anyphæna sp. (immature); may be gracilis, Hentz.

*Banks, Proc. Col. Acad. Soc., Vol. 13, 1904.

AGALENIDÆ.

Agalena pacifica, Banks. Black Mt. July.*
" Californica, Banks. Black Mt. October.*
Tegenaria Derhanii, Scopoli.
" Californica, Banks.*

DICTYNIDÆ.

Dictyna sublata, Hentz. Common in July.†
" volucripes, Keys. Also common.†
Dictyolathys Californica, Banks.*
Amaurobius severus, Simon. Rare.

THERIDIIDÆ.

Theridium placens, Keys. July.
" differens, Emerton. Rather common.
" fordum, Keys.
Linyphia diana, Keys. Rare.
" phrygiana, Koch. Common.
" communis, Hentz. Not rare.†
Latrodectus mactans, Koch.
Bathyphantes sp. (pallidula ? Banks).

MIMETIDÆ.

Mimetus interfector, Hentz.

EPEIRIDÆ.

Epeira gemma, McCook. Abundant.
" pacifica, McCook.
" trifolium, Hentz.
" labyrinthea, Hentz. Fairly common.†
" displicata, Hentz. Plentiful in July.†
" oacensis, Keys.
" aculeata, Emerton. Not rare.
" strix, Hentz. Very common.†
" vulgaris, Hentz. Rather rare.
" pegnia.
Zilla Californica, Banks. October and November.*
Cyclosa conica, Pallas. Rare.
Crytophora Californiensis, Keys. Rather common.†
Argiope argentata, Fabr. Rare.
" transversa, Emerson (trifasciata, Fors.).
Gasteracantha hexacantha, Fabr.

TETRAGNATHIDÆ.

Tetragnatha extensa, Linn.

" laboriosa, Hentz. Rare.

Hyptiotes cavatus, Hentz. Scarce.

THOMISIDÆ.

Xysticus Californicus, Keys. May. Uncommon.

Coriarachne versicolor, Keys.

Misumena vatia, Clerk.

" importuna, Keys.

" very.

" pictilis, Banks.*

Tibellus Duttonii, Hentz. July.

" oblongus, Walk. Fairly common in September.†

Philodromus rufus, Walck. Rather common.†

" mœstus, Banks.*

" Californicus, Keys. Rare.

LYCOSIDÆ.

Lycosa brunneiventris, Banks.

Pardosa Californica, Keys. July.

" stemalis? Thor. Common.†

OXYOPIDÆ.

Oxyopes salticus, Hentz.

" rufipes, Banks.

ATTIDÆ.

Phiddipus Johnsoni, Packham. Rather abundant.†

" opifex, McCook.

Dendryphantes octavus, Hentz. Frequent.†

" seneolus, Curtis. Several specimens.

Epiblemum palpilis, Banks.*

CATOCALA TITANIA, Dodge.—Mr. W. Beutenmuller informs me that the moth I have hitherto sent to friends as *Catocala præclara*, G. and R., is not that species, but *C. titania*, Dodge. As in a long series I am unable to detect any variation, and I do not find the silky lustre on the fore wings which is characteristic of *C. præclara*, I conclude that this species does not occur here.—E. FIRMSTONE HEATH, The Hermitage, Cartwright, Manitoba.

GEOMETRID NOTES, WITH DESCRIPTIONS OF NEW SPECIES.

BY L. W. SWETT, BEDFORD, MASS.

Eupithecia Taylorata, nov. sp.—Expands 22–23 mm. Discal spots on all wings black and distinct. Palpi rather long with black scales, antennæ ringed minutely with black. Fore wings ash-gray with darker shadings, five dark gray costal patches somewhat diffuse, from which as many wavy lines run across the wing to inner margin; lines are white towards outer margin, shaded heavily with black scales towards body, the first and second basally run in waves to inner margin, the third almost touches black costal spot, broader than the other two, and runs irregularly to inner margin; extra-discal line is heaviest, and is strongly angled beneath costa, where it bends back and runs irregularly to inner margin, beyond this the fifth and last band is bordered on outside by a white zigzag line further in from outer margin than usual in the *Eupithecias.* The margin of wing is pale ash, fringe pale ash, with dark patches at veins, and shorter than *interruptofasciata,* its nearest ally. Hind wings have five pale ash bands with darker shadings, extra-discal is most prominent.

Beneath: fore wings have three prominent bands, the basal shaded with fuscous to body, extra-discal strongly angled below costa, less waved than above and fainter, runs to inner margin, the marginal band corresponds to white zigzag line on upper side, but white shows only faintly beneath, and is not zigzag, rounded to inner margin. Hind wings have four wavy lines—two intra-discal, two extra-discal, heaviest on inner margin, very wavy between veins, dark patch at end of veins in fringe. This resembles superficially *interruptofasciata,* but is very distinct in its five whitish lines with black shadings and white zig-zag line well in from outer margin. I name this species in honour of my friend, the Rev. G. W. Taylor, who has done so much work in this difficult genus.

Type.—♂, May 29, 1901, Sherborn, Mass.; ♀, June 20, 1906, Monmouth, Me.

Eupithecia Frostiata, nov. sp.—Expands 15–18 mm. Discal spots black and distinct. Palpi moderate brown-scaled, wings of a reddish-brown cast. Four prominent costal patches, from which as many lines run to inner margin: first line, basal, rounded to inner margin; second parallel to it; third costal patch has white patch bordering it towards outer margin of wing, angled strongly below costa, then continuing in

broken minute dots on veins to inner margin ; then a pale reddish-brown band, outer edge of which is shaded heavily to outer margin of wing, a pale white line runs near outer margin zigzag, but hardly discernible. Fringe rather long and cinereous, with patches at end of veins. Hind wings lighter basally, with four or five lines broken into dots on veins, rounded across wings, discal spot much smaller and fainter than on fore wings, where it is large and rounded, fringe checkered as on fore wings.

Beneath : fore wings paler brown than above, extra-discal bands most noticeable, bent in curves and not dotted on veins as above. Hind wings have three dotted lines, one basal, the other two extra-discal, the marginal one being faintest.

This species may be known by its long narrow wings, reddish-brown cast on costa and patches, with large, round discal spot on fore wings.

I name this species in honour of Mr. C. A. Frost, who has done much in collecting material from Maine for my New England faunal list of Geometridæ, which I hope to publish shortly.

Type.—♂, New Windsor, N. Y. Coll. of G. W. Taylor. ♀, New Windsor, N. Y., April 25, 1895.

Co-types.—July 3, Newark, N. Y., W. H. Broadwell ; May 18, 1896, New Windsor, N. Y., Miss Morton.

I find, in examining the types of Packard's collection, that *Eucymatoge Strattonata* is not *anticaria* at all, but is a distinct species and is a *Eupithecia*, so it will stand as *Eup. Strattonata* in our lists. *Miserulata* was evidently unknown to Packard, as he has many species so listed under that name.

In studying his collection, I advise all to read over the original descriptions, as many of his labels have been changed, and in some cases the specimens are missing.

Eupithecia Grossbeckiata, sp. nov.—Expands 16 to 18 mm.; palpi about 1 mm., extending well beyond head ; rough scaled, antennæ strongly ciliated beneath. Colour of fore wings light fawn gray. A basal line very faint, but showing plainly by spot on costa, then intra-discal line very plain on costa, fading as it approaches inner margin on vein 2, separated as if broken off, then runs to inner margin. Discal spots prominent, somewhat linear and black. Extra-discal line represented by large spot on costa, then elbows out towards outer margin at vein 9. and bends back in gradual curve to vein 2, marked strongly on the veins as dashes ; from vein 2 it runs in two scallops to inner margin. Beyond

extra-discal line is a pale broad luteous band, strongly elbowed outwards below costa, running straight to inner margin. This band is bordered on outside by a darker gray band, which has a white finely-scalloped line in middle. Fringe short, gray, with intervenular dots.

Hind wings same colour as fore wings, prominent black discal spot, beneath this is a broad confused black line, forming a deep sinus as it runs towards outer margin, the basal line is hardly visible; the outer margin of wing is dusky-gray. Beneath lighter than above; three prominent costal spots the beginnings of lines, the extra-discal line being very black and confused, outside this the pale yellow band shows very prominently. Discal spots on all wings plain as above. Markings on hind wings same as above.

This species may be known from all others by its strongly-ciliated antennæ, pale yellowish extra-discal band, black, broad discal band and dark brown band on middle of abdomen, also white geminate spots on outer margin.

Types.—Two ♂'s, July 11 and 14, 1906, Framingham, Mass., Mr. C. Frost.

I take pleasure in naming this distinct and easily-recognized species after Mr. J. W. Grossbeck, who has done so much to help us in regard to the Hulst types.

Chlorochlamys inveterascaria, nov. sp.—Expands 20 mm. Antennæ bipectinate, but much shorter and stouter than in *chloroleucaria;* palpi moderate, a little longer and stouter than usual, rose-tipped; hind tibia one spur, hair-pencil. Fore wings long, rather pointed, somewhat resembling *Nemoria pistaciata*. Hind wings rounded. Colour olive-green, basal line on fore wings runs from costa to inner margin, same as *chloroleucaria*, extra-discal line whitish, irregular, deep indentation at vein 2, bent back at an angle on costa. Hind wings same colour as fore wings; a whitish band extends across middle of wing, rather more rounded than in *chloroleucaria*. Beneath pale ochraceous-white, no markings discernible, discal dots wanting. Fringe not so long as in *chloroleucaria*.

This species seems to be nearest *volantaria*, Pearsall, but differs in antennal structure, and the extra-discal line is not rounded outwardly, but is bent at an angle at costa; also, it is not waved, but irregular. It may be told at a glance by the short stout pectinations on the antennæ and the extra-discal line.

Hab.—Tucson, Arizona, May 11, 1905. Type, one male.

LEMONIAS QUINO (BEHR), SCUDDER: ITS SYNONYMY AND ACTUAL STATUS.

BY FORDYCE GRINNELL, JR., PASADENA, CALIF.

Lemonias Quino (Behr), Scudder, was described in the Proceedings of the California Academy of Science, Vol. III, p. 90–91, 1863. Since that time it has been interpreted in every possible way but the correct one. By some curious process of reasoning, the locality was changed to Mendocino county, evidently on the authority of Henry Edwards, and subsequent authors have adopted this conclusion, and tried to identify this species from that locality. Henry Edwards, in describing *Melitæa Baroni* and *rubicunda*, compares the latter with *Quino*, and thinks it might be only a variety of that species; but W. H. Edwards, in the "Butterflies of North America," 3rd series, 1897, says of this, as follows: "*Rubicunda* was originally described by Mr. Henry Edwards as possibly but a variety or form of *M. Quino*, Behr. Curiously enough, no one, not even Dr. Behr himself, knows what *Quino* is, or was intended to be. The types were lost, and the published description fits no known species or variety. *It certainly was not what Mr. Edwards understood it to be** when he compared both *Baroni* and *rubicunda* with it. He says of the latter that 'red is the prevailing tint, and the submarginal bands of secondaries are simply bands of red.'"

It seems strange that anyone could get the idea that *Quino* was distinguished by its black or dark coloration. Mr. W. G. Wright adopts this in his book, when by a cursory reading of the original description this is *not* the case, but the very opposite, it is even not as dark as *chalcedon*.

I have had slight suspicions in regard to *Quino*, but last spring when speaking with Mrs. Katherine Brandegee, of Berkeley, who has studied quite fully what she took to be *Lemonias augusta*, Edwards, in the vicinity of San Diego, on the authority of some eastern men, the question of the proper name of the San Diego form came up—whether it was *augusta* or *Quino*; I then resolved to look into this matter fully, and try, if possible, to set students on the right track. Mrs. Brandegee, being occupied with botanical questions, has no time to look into entomological work, but expressed herself as much interested in the true answer to the question.

*Italics are mine.—F. G.

Having had some correspondence with Mr. Wm. S. Wright, of San Diego, I obtained a good, lengthy series of *Lemonias augusta*, or what he seemed to be pretty well convinced was such a species, evidently on the same authority as that of Mrs. Brandegee.

As I said before, a cursory reading of the original description cannot possibly make out *Quino*, as understood by Hy. Edwards or Wright; and as I do not think that Behr's description can be improved on, and it has been neglected so long, I will quote it entirely.

"3. *M. Quino,* Behr, n. sp.

"*M. chalcedonti* similis sed antennæ clava discolor, fusca nec concolor antennæ reliquæ aurantiacæ.

"Alæ supra ut in *M. chalcedonte* sed series macularum submarginalium in anticis rubra et marginalium in posticis flava rubro tincta. Series quarta in anticis bifida, fere tota rubra, tertia in posticis omnino rubra.

"Alæ inferiores subtus ut in *M. chalcedonte* sed fascia flava prope radicem in maculæ sex dissecta maculaque flava discalis puncto ejusdem coloris extus aucta.

"*Melitæa Quino* may at once be distinguished by the entirely different and *much gayer coloration* of the upper side, which much more resembles that of *M. anicia* than *M. chalcedon*. To the latter species it comes the nearest in the peculiar shape of the wings, so characteristically different in the two sexes. In *M. anicia* this difference exists, but not to the same degree. *The yellow part of the under side of the hind wings is much paler than in M. chalcedon and M. anicia.* The yellow radical band is dissolved into six distinct but nearly connected maculæ. In *M. chalcedon* the band is not interrupted, and only the sixth macula is separated, making part of the yellow coloration of the anal side of the wing. *From M. anicia it differs besides in the under side of the fore wings being nearly all of a reddish-brown colour, with scarcely any indication of the markings of the upper side, closely resembling M. chalcedon. From both species M. Quino differs in the coloration of the club of the antennæ.**

"This species I received from Dr. Cooper, formerly of the State Geological Survey, who collected several specimens near San Diego. I have called it *Quino* in remembrance of the Californian pioneer, Padre Quino, the first European that ever succeeded in erecting a permanent

*Italics in the above description are mine.—F. G.

settlement in California, and at the same time contributed very considerably by his learned writings to a more exact knowledge of these then scarcely discovered regions."

I have a large series of specimens of *Lemonias Quino*, about twenty-five specimens, received from Mr. W. S Wright, of San Diego, taken near that place. These all agree exactly with the above description, and I have very little to add to Dr. Behr's excellent diagnosis of *Quino*, beyond emphasizing the italicized parts. Mr. H. C. Fall has specimens taken on Mt. Roubidoux, near Riverside; while Mr. Wright figures his *augusta* from specimens taken near San Bernardino. The types described by Edwards were taken in the foothills near San Bernardino. *Augusta* is a synonym of *Quino*. My specimens were collected mostly on March 16 of this year (1907). Dr. Behr's specimens were probably collected along with *Synchloe Cooperi*, which is a spring species, at San Diego, so his description refers to the spring form. I have not seen specimens of later generations, which Mr. Wright refers to as different. Dr. J. G. Cooper, Zoologist of the State Geological Survey of California, under J. D. Whitney, from 1860–1864, explored different parts of California, and was at San Diego 1861–1862, making most of his observations and collections during March and April, 1862.

Grinnell & Grinnell, in the Journal of the New York Entomological Society, March, 1907, p. 42, list *Lemonias augusta* from the San Bernardino Mountains; that is an error, the species is *Lemonias anicia* (Doubl. & Hewits.), or a very close form thereto. The specimens seem to be typical *anicia*, and agree exactly with Dr. Behr's comparisons in the above description; it is interesting with *Cupido Hilda* and *Incisalia eryphon* in showing the close faunal relations of the high San Bernardino mountains and the high central Sierras. It is very peculiar that W. G. Wright does not figure or describe *anicia* from California, as it occurs within a couple of days' trip from his home, instead of giving a figure of a Colorado form which is not quite typical; he even goes so far as to say that he does not know it from the "West Coast Territory," when California is the type locality!

Lemonias Quino is intermediate between *anicia* and *chalcedon*, as can be inferred from Dr. Behr's description. It is related to *anicia* by the prevailing red colour, while both *chalcedon* and *anicia* have the entire antennæ yellow, including the club; while in *Quino* the club is mostly

black, and remainder of the antennæ red-brown. W. H. Edwards, in his description of *augusta*, says, as follows : "belongs to *chalcedon* group, but is as conspicuously red as the species of *chalcedon* is black." Dr. Behr says practically the same thing of his *Quino;* a comparative description like that of Dr. Behr is, to me, of much more use than one that attempts to describe all the complicated markings of these insects.

The synonymy, etc., stands thus :

Lemonias Quino (Behr), Scudder. Proc. Cal. Acad. of Sci., III, p. 90, 1863.

Melitæa augusta (Edwards), CAN. ENT., XXII, 21, 1890.

Melitæa augusta (Wright), Butt. of the West Coast, p. 153, pl. XIX, 1905.

Melitæa augustina (Wright), loc. cit., p. 154. (This is only an individual variation.)

Melitæa augusta (Holland). Butterfly Book, p. 141, pl. XVI, 1899 (a very lightly marked specimen).

Type locality : San Diego, California.

Distribution : Lower Sonoran Zone of the San Diegan Faunal District.

Food plant : Plantago patagonica (Mrs. Brandegee).

Lemonias Quino is, so far as known, limited to the southern half of the San Diegan Faunal District, and extends into Upper Sonoran. *Lemonias anicia* is an Upper Transition species, while *Lemonias chalcedon* extends from Lower Sonoran to Lower Transition.

ACKNOWLEDGMENT.—The Curator, on behalf of the Entomological Society of Ontario, desires to offer its very grateful thanks to MR. F. H. WOLLEY DOD, of Millarville, Alberta, for his handsome gift of over two hundred specimens of Lepidoptera. These are for the most part North-western species that were unrepresented in the Society's collection, and are therefore very welcome and useful accessions.

Also to MR. CHARLES R. ELY, of Washington, D. C., for a generous gift of fifty specimens of Lepidoptera from Connecticut, which are of much value in filling gaps in the Society's cabinets.

DESCRIPTION OF *EUPITHECIA FLETCHERATA*, A GEOMETRID MOTH FROM OTTAWA, NEW TO SCIENCE.

BY GEO. W. TAYLOR, WELLINGTON, B. C.*

This is one of the broad-winged, medium-sized species of *Eupithecia*, in wing shape much line *Eupithecia latipennis*, Hulst (which is quite common in Ottawa in the month of June), but is a trifle smaller. Expanse, 21 mm.

Palpi of moderate length, rather bushy, very dark (nearly black), with the extreme tips white. Front dark gray, with a fine black transverse line in front of the base of the antennæ.

Thorax gray, darker in front; a small white posterior tuft. Abdomen dark smoky-gray; last segment darker, but in the male with a tuft of snow-white hairs seen only when the last segment is exserted; dorsal tufts black; a black lateral line.

Beneath the pectus is white; the abdomen pale except the last segment, which is dark gray; the legs are pale except the tibiæ and tarsi of the first pair, which are dark, with pale rings. Fore wings rather dark gray, with blackish cross-lines enlarged on the costal margin.

The basal and intra-discal lines, with at least two intervening lines, are parallel to each other; they leave the costa at a sharp angle, turning at right angles when they reach the cell, and running in an almost straight line to the inner margin; they are all farther from the base at the inner margin than at the costa.

The median line, which is double, takes much the same direction, including in its angle the distinct, oval, black, discal spot, and continuing in a wavy line to the inner margin.

The extra-discal line appears as a large blotch on the costa; it then runs in a regular curve to vein 3, then parallel to the median line to the inner margin; this line is emphasized by a series of eight black dashes on the veins.

Between the extra-discal and the submarginal lines are three dark lines, showing only as spots on the costa.

The submarginal line is faint, white, showing most plainly in a white dot between veins 3 and 4, and another between 1 and 2. Marginal line faint, black, broken at the veins. Fringe, basal half darker; dusky spots at the ends of the veins.

*Reprinted by request from The Ottawa Naturalist, Vol. XX, No. 10, pp. 200-202, January, 1907.

Hind wings dark gray; the lines indistinct, but apparently all the lines of the fore wings are continuous, the most evident being the extra-discal and the submarginal; the first-named consists of black dashes on the veins (as on the fore wing), and so appears broader than the other lines.

Discal dot black, distinct. Fringe as on the fore wings. Beneath, fore wings bright gray. Costa with black marks showing the commencements of basal, median and extra-discal lines, and with another dark blotch in advance of the faint white submarginal line.

The extra-discal line and a dark gray shade beyond it are traceable across the wing to the inner margin, but the other lines can only be followed for a very short distance from the costa.

Marginal line distinct; base of fringe pale, otherwise as above.

Hind wings pale, with three intra-discal lines marked on the costa and again on the inner margin.

There are also two extra-discal lines composed of distinct dots on the veins.

The outermost of these is parallel to the outer margin; the other runs in a straight line from the inner margin, in the direction of the discal dot, to vein 3, then in a regular curve to the costa. These two lines are, therefore, not parallel, being rather close together on the costa and farthest apart on vein 3. This is a peculiarity that I have not noticed in any other eastern *Eupithecia*. Three or four dots on the veins indicate another line between the two just mentioned.

Discal dots distinct on all wings.

Described from two specimens collected by Mr. C. H. Young, and labelled respectively Ottawa, 3, viii, '06, and 10, ix, '06, and named in honour of Dr. James Fletcher, of Ottawa.

One of these specimens is in my cabinet, thanks to the generosity of Mr. Young; the other is retained in his own collection.

PRACTICAL AND POPULAR ENTOMOLOGY.—No. 24.

Sugaring for Moths in the Autumn.

BY JOHN A. MORDEN, HYDE PARK CORNERS, ONT.

It may be interesting to Lepidopterists to know what success I had during the late autumn of last year in sugaring for moths, especially those of the genus Scopelosoma.

Having read the highly-interesting article by Mr. Henry Engel, of Pittsburg, Pa., on collecting moths in autumn and winter (Can. Ent.,

Vol. XXXVII, page 102), I determined to follow his example during the autumn of 1905. After many weary visits to baited trees, and finding nothing more desirable than *Orthosia ferruginoides*, *Agrotis ypsilon*, *Peridroma saucia*, *Xylina antennata*, and *Plathypena scabra*, I abandoned the undertaking early in October, with the conclusion that there were no Scopelosomas in this locality, and certainly no such variety of moths as Mr. Engel met with. This proved to be a mistake as far as Scopelosomas were concerned, for during the following maple-sugar season I took over one hundred specimens that were feeding upon sap which oozed from wounds in the maple-trees caused by the common Sapsucker —the yellow-bellied Woodpecker (*Sphyrapicus varius*). In the sugar woods where the trees were tapped for syrup, many had become drowned in the sap-pails. I found that submerged specimens were spoiled, but those floating and not saturated were fit for mounting.

Subsequently I read Mr. Engel's article again, and noticed that he did not mention any captures of Scopelosoma before October 21st. I had received the impression when first reading it that he had taken specimens of this genus much earlier, and others, perhaps, have made the same mistake. Accordingly, last autumn (1906) I baited a number of trees, and continued to visit them early in the evenings without meeting any particularly desirable specimens until October 26th, when one Scopelosoma was captured. On the next evening, which was rainy, I took seventeen specimens, on Nov. 3rd twenty-two, Nov. 10th fifteen, Nov. 17th seventy-one, Nov. 26th thirty-two, and there were other dates when I took from four to six examples. These moths do not come to feed at the bait to any extent upon evenings which follow warm, sunny days ; they prefer to feed just before, or during, a shower of rain and when there is a thaw after frost. On Nov. 3rd there was enough snow in the woods to give the ground a speckled appearance, and yet I took over a score of these moths. Favourable weather seemed to occur every seventh day till Nov. 17th. The following are the species taken : *Scopelosoma Morrisoni*, *Græfiana*, *Walkeri*, *sidus*, and some others yet to be determined. After rejecting imperfect specimens, I pinned no less than one hundred and fifty-two examples of this genus.

I may add that during September of this year—from the 12th to the 23rd—I have taken 104 specimens of Catocala, forty being *concumbens*, 22 *unijuga*, 8 *habilis*, 6 each of *cara* and *innubens*, and lesser numbers of *parta*, *briseis*, *amatrix*, *bianca*, *neogama* and *piatrix*.

BOOK NOTICES.

FARM WEEDS OF CANADA, by George H. Clark, B. S. A., and James Fletcher, LL.D., F. R. S. C., F. L. S., with illustrations by Norman Criddle. Published by direction of the Minister of Agriculture, Ottawa, 1906, 4to, pp. 103.

It is seldom indeed in this country that so beautiful and useful a book as this is published by a Government Department, and we may therefore all the more heartily congratulate Dr. Fletcher on being enabled to produce this admirable volume. The name of Mr. Clark appears upon the title-page as copied above, but his share in the authorship seems to be limited to a single introductory page. To Dr. Fletcher is evidently due the entire credit for the literary and scientific part of the work, and to Mr. Criddle for the exquisite coloured plates, 52 of weeds and 4 of seeds.

At the outset of the volume an account is given of the losses to farmers caused by weeds, and full and clear instructions for their extermination are provided; weeds are defined and classified, and a clear explanation is given of the botanical terms necessarily employed in the work. The rest of the volume is taken up with descriptions of all the important weeds that trouble the farmers, especially in the newer Provinces of the West; the common English as well as the scientific names are first given in each case, then follow a list of the Provinces it infests, a description of the plant, time of flowering, method of propagation, situations in which it occurs, the injury it causes, and the best remedy to be adopted for its eradication. In the great majority of cases clean farming and a short rotation of crops are the remedies recommended, but where carelessness has allowed the land to be seriously infested special methods have to be resorted to.

With this work to refer to, no intelligent farmer should have any difficulty in identifying the weeds with which he has to contend, nor should he be at a loss to know in what manner he can successfully wage war upon them. With the plates alone, so beautifully true to nature are they and so artistic as well, any ordinary weed can be identified, and reference may then be made to the description that accompanies them.

Whether the work is for sale to the public, or is to be obtained only by application to the Ottawa Department of Agriculture, is not stated. No doubt every one who farms many acres will wish for and should have a copy. Weeds allowed to go to seed are not only an injury to the man in whose fields they occur, but are a menace to his neighbours in all

directions. Their eradication is consequently a public necessity, and all farmers should know what to do and be compelled to do it.

INSECTS INJURIOUS TO VEGETABLES, by F. H. Chittenden, Sc. D., U. S. Department of Agriculture. New York: Orange Judd Company, 439–441 Lafayette Street; 262 pages, 163 illustrations. (Price $1.50)

The author of this excellent manual is so well known as a thoroughly skilled economic Entomologist from the numerous Bulletins that he has written, that it is hardly necessary to say a word regarding the accuracy, clearness and practical character of the book. All the insects that any vegetable grower is likely to meet with are described and figured, and plain, simple methods of control are given. The first four chapters give a brief account of the various orders of insects, the natural elements that control them, prevention by farming and mechanical methods, and the most approved insecticides, with directions for making and using them. The remaining chapters give full information respecting a great number of insects arranged under the vegetables that they attack. A list of publications on Economic Entomology and a copious index complete the work. Everyone who possesses a garden and tries to grow vegetables, should have this volume at hand for speedy reference when any insect foe attacks his crops; all the information needed for identifying the enemy and waging successful warfare against him can at once be found, and with little difficulty be put in practice. Students in Agricultural Colleges and teachers of Nature Study will also find much assistance in their work from the perusal of this volume, and will continue to regard it as a mine of useful information.

ONTARIO BULLETINS.

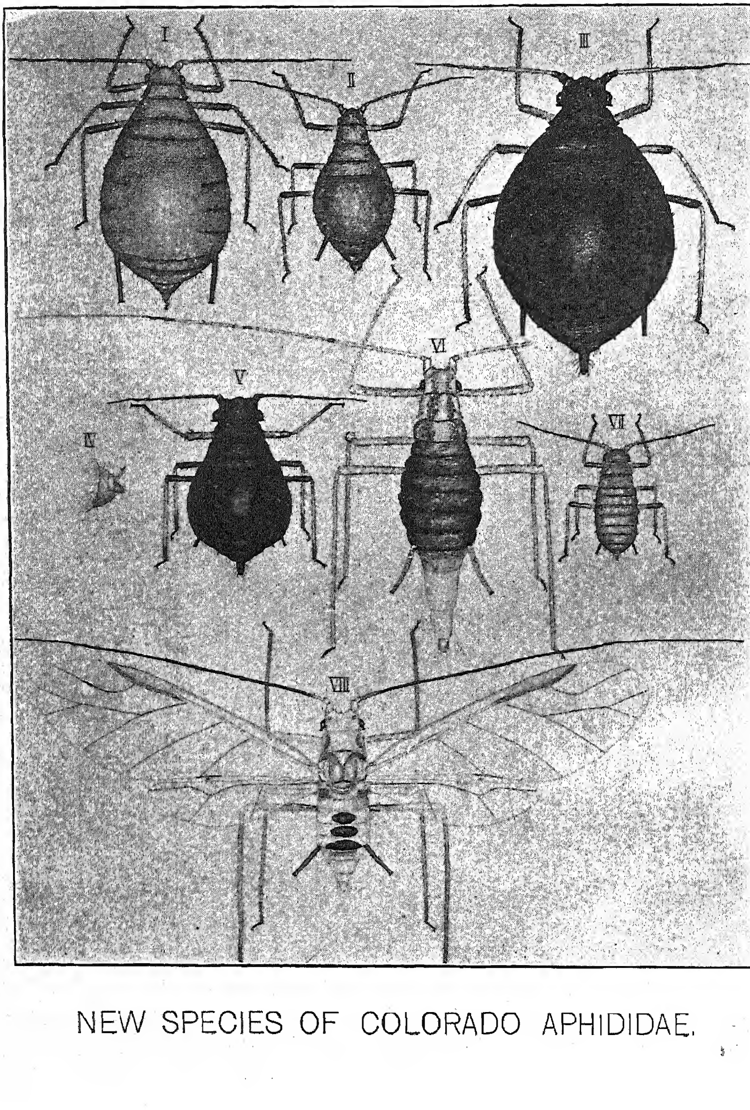
The Ontario Agricultural College, Guelph, has recently issued the following useful Bulletins on Economic Entomology. They can be procured on application to the Ontario Department of Agriculture, Toronto, by whom they are published:

INSECTICIDES AND FUNGICIDES (Bulletin 154), by Professor R. Harcourt and H. L. Fulmer, of the Chemical Department; 32 pages.

REMEDIES FOR THE SAN JOSE SCALE and the San Jose Scale Act (Bulletin 157); 12 pages.

INSECTS AFFECTING FRUIT TREES (Bulletin 158), by Professor C. J. S. Bethune; 36 pages, 50 illustrations.

Mailed November 5th, 1907.



NEW SPECIES OF COLORADO APHIDIDAE.

The Canadian Entomologist.

VOL. XXXIX. LONDON, DECEMBER, 1907. No. 12.

NEW SPECIES OF COLORADO APHIDIDÆ, WITH NOTES UPON THEIR LIFE-HABITS.

BY C. P. GILLETTE, FORT COLLINS, COLORADO.

In our study of Colorado Aphididæ during the past two or three years, we have endeavoured to trace each species throughout the entire year. In doing this work it has been necessary to make careful descriptions of the lice in all their stages of development. On account of inadequate descriptions of some of the described species, it is impossible in some cases to decide whether a louse under examination is a described species or not, and in other cases there seems to be very little doubt but that the species being studied is new to science. Some of the apparently new species I am describing below. If in any case an old species should be redescribed, I hope I shall give the description and the life-habits full enough in each case so that other workers may be able to tell upon what species I was working. Even this in some cases may not be an easy matter.

Unless otherwise stated, the descriptions are made in each case from fresh living specimens, and the colours given as they appear under a hand lens.

Aphis torticauda, n. sp.

A large red louse on native thistles, *Carduus* sp. Light to dark red in general colour, with antennæ and cornicles black.

Apterous Viviparous Female (Plate 11, figs. 1 and 4).

Described from specimens taken at Fort Collins, Colo., July 22, 1907.

Length, 3.5 to 3.75 mm; width, 2 to 2.20 mm.; antenna, 3 mm. Joints: III .9, IV .6, V .5, VI .14, VII .6 mm. Joint 3 with about 30 and joint 4 with 12 or more small circular sensoria. Joints 1 to 6 with a few short stout hairs on each. The antennæ are upon slight tubercles, and there is a small blunt tubercle on either lateral margin of the prothorax and each abdominal segment. The entire dorsum, including head, unicolorous-red; eyes, distal ends of femora, tibiæ, and all of tarsi, cornicles and antennæ black or blackish. Cornicles about .75 mm. long,

cylindrical, enlarging little or none toward base, and with distinct flange at apex. The cauda is very peculiar in form, is directed up and back, and is moderately broad at the base, but soon becomes small, tapering and crooked, appearing as if it had been twisted off. (Fig. 4.) Beneath the cauda the anal plate is protruded into a blunt point projecting back and ventrally, and appearing, often, more like the ordinary blunt conical cauda than does the real cauda. I have not seen a similar cauda in any other species. Beak long, much surpassing hind coxæ, the third joint long and slender.

Winged Viviparous Female.

Specimens taken by L. C. Bragg at Longmont on June 14, '07,

Differs little from the apterous form; the cauda is somewhat straighter and more symmetrical, wings rather stout, 4 mm. long, with subcostal nervure and stigma rusty-brown. Length of body about 3.4 mm., antenna much shorter, about 2.10 mm. Joints: III .61, IV .43, V .31, VI .14, VII .49 mm.; cornicles, .50 mm.

Winged Male.

Same date and place as the preceding females.

Colours as in the winged females. Length of body, 2.70 mm.; antenna, 2.40 mm.; cornicles, .54 mm. Antenna joints: III .65, IV .42, V .40, VI .13, VII .50 mm. Joints 3 and 4 strongly tuberculate, the former with about 40, and the latter with a single row of about ten small circular sensoria. Cornicles cylindrical, black. Cauda as in the alate female. Slight antennal tubercles.

Apterous Oviparous Female.

From specimens taken at Fort Collins, Oct. 27, '07.

Colour as in viviparous apterous form, except that the anal plates are conspicuously black.

Length, 2.5 mm. long by 1.35 mm. broad. Antenna, 1.8 mm. Joints: III .50, IV .36, V .30, VI .13, VII .43 mm. On joint 3 are a small number, about 15 to 25, circular, slightly tuberculate sensoria. The cauda is small, pointed, black, upturned, and does not show the peculiar twisted appearance as well as in the viviparous females. Beak reaches considerably beyond hind coxæ. Cornicles, .40 mm. Several specimens taken in copula. They are much smaller than the viviparous females. Oviparous females and males quite numerous, but I find no eggs yet. There are many ant attendants.

In nearly every colony I find a few very dark green oviparous females with reddish head and prothorax. I take them to be a colour variation only.

Apterous Male (Plate 11, fig. 7).

From specimens taken Oct. 26, '07.

General colour sordid yellowish-brown or greenish-rufous, with a pronounced tinge of rufous upon head and thorax, but without the bright red of the females. Antennæ, eyes, distal halves of femora and tibiæ, tarsi, cornicles, beak and anal plates black or blackish. Length of body, 1.75 mm.; length of antenna, 1.60 mm. Joints of antenna about as follows: III .36, IV .30, V .26, VI .11, VII .40 mm. Cornicles cylindrical, .17 mm. in length. Cauda very short, blunt and black. Third joint of antenna with about 20 small circular sensoria; joint 4 with about six, and joint 5 with about four. Joints with a few short stout setæ on each. Beak long, easily attaining hind coxæ.

This is the only plant louse that I have found having two sets of males. Those appearing in July did not continue long, and, being winged, had the semblance of very small females. No eggs were seen until after the appearance of the wingless fall brood of males during the latter part of September and October. This louse is always well attended by ants, and I have been unable to find eggs upon the food-plants in the field, but when the lice are brought into the laboratory and kept for a few days upon thistle, eggs are laid in considerable numbers. They are light green in colour at first, but become polished black in a few days. I cannot help wondering if the ants carry away the eggs.

On May 18 I found what seemed to be stem mothers of this species upon *Carduus* sp. at Akron, Colorado, and about each parent insect were a few light red young of different ages, and the thistles have been continually infested with the lice to the present writing, Oct. 20. We have not found this species infesting any other plant.

Aphis carbocolor, n. sp.

A black louse from stems and leaves of yellow dock, *Rumex*, sp.

Alate Viviparous Female, from Fort Collins, June 26, '07.

Black throughout, except for the greater part of the tibiæ and anterior femora, the proximal ends of the middle and posterior femora, and the long basal segment of the beak. The dorsal portion of the body is polished.

Body 1.9, wing 3, antennæ 1.3, cornicles .18 mm. Joints of antenna: III .34, IV .21, V .20, VI .11, VII .28 mm. Cornicles cylindrical, without marked thickening towards base, and without flange at distal end. Antennæ black, wing-veins black, with 2nd fork of cubital vein rather short, stigma rather short and, along with subcostal vein, a little greenish in colour. Hind tibiæ 1.1 mm. long. Prothoracic tubercles rather stout and prominent, and usually the abdominal segments show well-developed lateral tubercles. Cauda short, black and upturned; 3rd joint of antenna with about eight moderately tuberculate sensoria.

Apterous Viviparous Female (Plate 11, Fig. 3), taken along with the alate form.

Deep, dull, sooty-black throughout, never polished; tibiæ, except distal ends, most of anterior femora, bases of middle and hind femora, third joint of antennæ and basal joint of beak, pale yellow or slightly dusky in colour. Body short and broad, almost globular, about 2.5 mm. long by 1.6 mm. broad. Length of antenna 1.3 mm., and the joints measure about as follows: III .40, IV .24, V .22, VI .11, and VII .24 mm. respectively. Cornicles .26 mm. long, without flange at tip, and somewhat broadened towards the base; cauda short and upturned. Tubercles of prothorax and abdomen as in the winged form. There is considerable variation in measurements of antennal joints, but joint 3 is longest, and joints 4 and 5 are about equal.

Apterous Viviparous Female. Taken Sept. 23, '07, at Ft. Collins, Colo.

Varies little from early summer form, but is a trifle smaller. Measurements vary little from: length, 2.10 mm.; width, 1.10 mm.; antenna 1.10 mm.; joints of antenna: III .26, IV .20, V .19, VI .11, VII .23 mm. Cornicles, .21 mm.

Apterous Male (Plate 11, fig. 5), taken at Ft. Collins, Colo., Oct. 6. 1907.

In colour like the females or a little lighter, the abdomen being a dark olive green when put into alcohol. Length of body, 1.30 mm.; antenna, .94 mm.; joints: III .22, IV .16, V .14, VI .10, VII .20 mm. Joint 3 with 8 to 10 oval sensoria of varying size, and joint 4 with about half as many. Joints distinctly crenulate, especially those beyond the 3rd. Cornicles, .11 mm.

Apterous Oviparous Female, taken along with the males above.

Very similar to viviparous form, but a little smaller, about 1.9 mm. long; antenna barely 1 mm. Depositing yellowish-brown eggs about bases of dock stems. The eggs soon become polished black.

A very common species, and nearly all adults are getting wings now. The pupæ have very dark brown abdomens, and the thorax is dark green. The shorter cornicles dull black colour, and shorter 6th and longer 7th joints of the antenna are characters separating this species from *Aphis medicaginis*, with its shining black apterous females, and which infests a large variety of plants.

This was a very abundant louse upon the stems and leaves of *Rumex* during the month of June and the early part of July, 1907. By the last of July the enemies of this louse had so reduced its numbers that Mr. L. C. Bragg, who was making constant field observations for me, was able with difficulty to find specimens through the month of August, and then they were found close to the ground. By the first of October they had become quite abundant, but to the casual observer would be unnoticed, as they remained close to, or even somewhat beneath the surface of the ground. At this writing, Oct. 20, the males and oviparous females are very abundant, as are their eggs, upon the bases of the leaves and dead seed stalks. Winged females were abundant during June and July, but have been entirely absent since about the last of September.

So far as Mr. Bragg or I have been able to observe, this louse confines its attacks to the genus *Rumex*.

Drepanosiphum Braggii, n. sp.

I take pleasure in dedicating this interesting new species to Mr. L. C. Bragg, who is a most careful and enthusiastic student of nature, and who first discovered this species upon box elder at Fort Collins, in the summer of 1906.

Alate Viviparous Female.

Described from specimens taken at Fort Collins, Oct. 18, '07.

General colour of head, prothorax and abdomen pale greenish-yellow; of mesothorax pale yellowish-brown; eyes bright red, cornicles concolorous with the abdomen at base, rusty-brown in distal half, and may be black at extreme tips; antenna pale yellowish-brown, with distal ends of joints 3, 4, 5 and all of joint 6 black; tibiæ entirely dusky, tarsi blackish, femora all concolorous with abdomen. Antenna very long, filiform, a little more than twice the length of the body, 7th joint, if whole, the longest.

Length of body 3, wing 4.6, antenna 6.3 mm. Joints of antenna about as follows: III 1.5, IV 1.4, V 1.2, VI .22, VII 1.8 mm. Third joint with a single row of about 7 to 10 sensoria on the under side of the

basal half. The sensoria are rather small, transverse and not much tuberculate, and the sixth joint tapers gradually into the seventh. Frontal tubercles for antennæ large, vertex hardly convex, prothorax rather long and rectangular in form, and without lateral tubercles; cornicles .66 mm. long, cylindrical and somewhat constricted near distal end. Terminal joints of abdomen prolonged into a sort of short ovipositor (for depositing young). Cauda short, conical, upturned; beak barely attaining 3rd coxæ: length of hind tibiæ 2.6 mm.

These winged females are fairly common yet among oviparous females and young upon the under side of leaves of box elder on college campus. A very active louse with long legs, and it often jumps from the leaves when disturbed.

There seems to be no apterous viviparous form in this species.

Apterous Oviparous Female (Plate 11, fig. 6).

Described from specimens taken at Fort Collins, Oct. 18, '07, from the box elder.

In general colour varying from very light greenish-yellow to a sordid or even dusky yellow, becoming darker with age. Antenna very pale yellow, annulated with black as in winged form; colour of legs and cornicles and eyes as in winged form. The body of this egg-laying female is very peculiar in having an extremely elongated ovipositor-like end to the abdomen. The distance from the cornicles to the tip of the abdomen is nearly one and one-half mm., or more than one-third the entire length of the body. Length of body, 3.8 mm.; length of antenna 5.55 mm.; joints: III 1.2, IV 1.14, V 1.11, VI .20, VII 1.71 mm. Length of hind tibiæ 2.22 mm. Cornicles cylindrical, gently curved, enlarged slightly towards the base, and 6.5 mm. in length. Prothorax without tubercles; body set with scattering hairs; joints of antenna with a few minute hairs upon each segment. The cauda is small, broad and upturned, and quite inconspicuous. These females have fully-developed ova at this time, and are present in considerable numbers on the under side of the leaves of box-elder trees upon the college campus. I find them most common upon small twigs near the trunk and upon small shoots thrown out about the trunks.

Winged Male (Plate 11, fig. 8).

Specimens taken along with above described females.

General colour very light green or greenish-yellow, with or without a tinge of brown on head and thorax, and a deeper brown on more or less of cornicles. Upon the dorsum of the abdomen are two to four black

blotches in the region of the cornicles, and the antennæ are black to near the base of joint 3. Other dark parts as in alate female.

Length of body, 2 mm.; antenna, 5.2 mm. Joints of antenna as follows, with small variations: III 1, IV 1, V. 1, VI .17, VII 1.75 mm. Fully two and one-half times the length of the body. I think this is the longest antenna for length of body I have ever seen among the Aphididæ. Vertex barely convex between the frontal tubercles. Joint 3 with a very large number (probably as many as 100) small transverse sensoria occurring upon all sides, joint 4 with about half as many, and joint 5 with 20 or more, all upon one side. The young lice have capitate hairs.

Except for the long cornicles, this species seems a close relative of *Drepanosiphum acerifolii*, and it has the same general habits. The males are specially given to jumping when disturbed, and the strange-appearing oviparous females use their long drawn-out abdomen, which is suggestive of an elephant's proboscis, with which to feel around in the crevices of the bark of the trunk and large limbs for suitable places in which to deposit their pale yellow eggs, which are placed singly or in small clusters. The stem mothers in the spring also acquire wings as in case of *acerifolii*.

Egg laying begins about the first of October.

The box elder seems to be the only food-plant for this species, and it continues upon this food-plant throughout the season.

Callipterus robiniæ, n. sp.

From leaves of black locust, *Robinia pseudacacia*.

Winged Viviparous Female.

Described from specimens taken in Denver, Colorado, Sept. 3, 1907.

A pale lemon-yellow or greenish-yellow louse, with red eyes. Distal ends of joints 3 to 7 of the antenna, tarsi, extreme apex of short beak and a spot near distal end of hind femora black, and a dusky spot in stigma of wing. No other dark markings.

Length of body 1.6 to 1.8 mm. Length of antenna 1.6 mm., or barely attaining tip of abdomen, and without hairs. Joints: III .60, IV .38, V .34, VI .14, VII .07 mm. Sensoria rather large, transversely oval, closely placed, and about ten in number on basal one-half of joint 3. One large sensorium near the end of joints 5 and 6. Abdomen smooth except for a lateral row of small tubercles on either side. Subcostal vein of fore wing moderately bent forward at base of stigma, second transverse nerve moderately sinuate, nervures dusky-brown, costal nerve of hind wing sharply bent downward to meet second transverse nerve, the transverse nerves nearly straight; cornicles tuberculate, swollen at base, prominent; cauda knobbed. Head and prothorax broad, the latter without tubercles, middle ocellus prominent,

A white line beginning at base of each antenna extends over the dorsum of the head and thorax, and is continued over all segments of the abdomen as a powdery white spot upon each segment. There is also a broken line along either lateral margin, beginning back of each compound eye, and appearing as white spots on the abdominal segments to and including the 5th.

Oviparous Female.

Specimens taken at Denver, Colo., Oct. 12, '07.

General colour pale green, the dorsal surface of thorax and abdomen covered with numerous dusky spots and transverse dashes, each of the dusky spots giving rise to a capitate hair.

Length of body, 1.9 mm.; length of antenna, .95 mm. Antenna joints: III .36, IV .20, V .14, VI .11, VII .06 mm. Antenna dusky-brown to blackish in colour, with joints 1, 2 and 3 lighter. Legs dusky-brown; cornicles short, tuberculate, not longer than broad; cauda very small and upturned. Segments 6, 7 and 8 of abdomen much prolonged. No sensoria on any of the segments. Eyes red, or gray with red centres.

Winged Male.

Taken from black locust at Denver, Colo., Oct 12, '07.

General colour light green, with head, middle of pronotum, lobes of mesothorax, scutellum, transverse dash on the hind margin of metathorax, abdominal segments 1 to 6 inclusive, and transverse bands on segments 7 and 8 black. In some examples these black dashes do not show on all of the segments. The tip of the abdomen, the antennæ, distal portions of the femora, tarsi, pleura of mesothorax, and the mesosternum are also black or dusky in colour. Eyes light red at centre, but gray about the margins.

Length of body, 1.50 mm.; length of antenna 1.11 mm. to 1.6 mm.; length of wing 2 to 2.40 mm. The veins of the wing slightly dusky. Cornicles very short, tuberculate, not longer than broad. Joints of antenna: III .60, IV .34, V .30, VI .16, VII .09 mm., with considerable variation in different specimens. Joint 3 has a single row of about 15 to 20 transverse sonsoria upon the under side. Joint 4 about six, and joint 5 about five, and joint 6 with three similar sensoria. Abdominal segments 1 to 5 are tuberculate upon lateral margins.

The white lines and spots described for the viviparous female are also traceable to a greater or less extent upon the male, and are usually quite distinct upon head and thorax. The black dashes on segments 3 to 6 of the abdomen may be indistinct, missing, or in spots only.

FURTHER NOTES ON THE OCCURRENCE OF HEPIALUS THULE, STRECKER, AT MONTREAL.*

BY H. H. LYMAN, M.A., MONTREAL.

In 1893 I read a paper on the occurrence of Hepialus Thule, Strecker, at Montreal, before the Entomological Club of the American Association for the Advancement of Science at Madison, Wis., which was afterwards published in the December number of the CANADIAN ENTOMOLOGIST of that year. That paper embraced everything that was known of this species up to that date, but since then various facts of interest in connection with it have come to light.

From the above date, I hunted for it in its then only known locality every year when at home in its season, but absolutely without success up to July, 1901, when, on the 11th of that month, after a hard bicycle ride out on the upper Lachine road, I arrived at the spot on the brow of the old sea terrace where others had seen it, in time to see one swinging back and forth in its peculiar oscillating flight. Hurriedly mounting my net I made a stroke at it, but the tall growth of grass and weeds masked the edge of the bank, and I missed my footing and came down sprawling, the coveted prize, as usual, dropping into the grass. I was up again at once, and when the moth again rose in flight, but this time straight away to escape, I made a more accurate stroke and secured it, but that ended the sport, and no other was seen either on that evening or subsequently.

In 1902 it occurred to me that there was no reason why the species should not be found at Montreal Junction, situated on the brow of the same old sea terrace, a few miles further to the south-west, at a point where it began to trend to the north-west, and as it was much easier to go out the ten minutes' run by railway than to ride out to the other point on a bicycle, I suggested to Mr. Winn our making a trip out there on the evening of July 16th. We reached that point a few minutes before 8 o'clock, and agreed to separate, as we could thereby cover more ground. Mr. Winn went to the south-east, while I went more to the north-west to a pasture on the brow of the terrace just beyond the house of a cousin. There was a steep gully, probably caused by a landslide many years ago, running down to the lower level covered by bushes and scrub of various kinds, and in this gully several large trees had grown up. I had only just got to the place when I saw a number, apparently half-a-dozen or more, swinging back and forth in the air, as though participating in a dance,

*Read before the Annual Meeting of the Entomological Society of Ontario, Nov. 1st, 1907.

above the further edge of the gully and quite out of reach of my net. Gradually one swung lower and lower, till by making an upward spring I was able to secure it. It was a male in perfect condition. After that the others mounted over the tops of the trees in the gully, where it would have needed a fifty-foot pole to reach them, and I could only stand and watch them till, as the dusk deepened, they gradually disappeared, but where I could not see. I could only see that gradually there were fewer in the group, till at last all had vanished. Mr. Winn saw none where he went. I went out again a night or two afterwards with a long bamboo fishing-pole, to the end of which I could attach a net, but, though the evening appeared favourable, not a single moth appeared. My cousin having kindly offered to look for these moths for me, I left the net and killing-bottle with him, and he went out every fine evening as long as there was any chance of finding them, but none were seen. The next year, 1903, I again went out on the 13th of July, and my cousin again hunted for me, but none were seen.

In this year Mr. Charles Stevenson's family spent some time at Montreal South, between Longueuil and St. Lambert, and Mrs. Stevenson discovered a locality for *Thule* not far from the house where she was staying, and ten specimens were taken. Learning the whereabouts of the locality, I went over on the evening of July 18th, in company with Mr. Winn, but none were flying. In 1904, I believe, I again tried to find them, but again without success, but this year my cousin's perseverance was rewarded by securing one specimen. In 1905 they were very plentiful at Montreal South, and many were taken on different evenings by the members of the Montreal Branch, the evenings on which I took them being the 8th, 12th and the 15th, on which latter date they were becoming ragged. The locality is a tract of land used as a pasture, but a large part of it is covered by a young growth of various trees and bushes, among which willow scrub is prominent. From the fact that many of the moths were taken among or near the willows, it seemed probable that the larvæ bored in the roots of that tree, but the credit for the actual discovery belongs jointly to Mr. Charles Stevenson and Mr. A. E. Norris, who went over by an early boat on a Saturday afternoon and searched carefully among the willows, and were each rewarded by finding a cast pupa-skin on the ground among the willow roots.

The same year Mr. Arthur Gibson discovered the species at Ottawa, as he has interestingly told in the Ottawa Naturalist (Vol. XIX, 117),

attention being drawn to the fact that the moths in life are of a much brighter yellow than in the cabinet, the colour changing soon after death. Mr. Denny has informed me that in 1905 Mrs. Denny discovered another locality for it at Amherst Park, on the northern outskirts of Montreal, and that a number were taken by his family and by Mr. Stevenson, and the latter has informed me that he also found it in a different locality.

In 1906 I was absent in England, but am informed by Mr. Winn that he visited the locality at Montreal South three times, and took twelve specimens in all, and Mr. Denny also took it at Amherst Park. This year I again visited the locality at Montreal South, but with very poor results. The first time was the evening of the 13th of July, but, though conditions seemed favourable, none were flying. I supposed that owing to the lateness of the season I was too early. I intended going over a week later, viz., Saturday, the 20th, but the weather was rainy. On the 24th I went again, and while hurrying along the railway track on my way to the locality I sighted a single specimen indulging in the usual gambol back and forth, but this time not more than five feet above the ground. I hastened to mount my net, but while doing so had to back away from the moth, which in its oscillating flight was gradually approaching me, as though attracted by the white waistcoat which I was wearing; as soon as possible I made a stroke with my net and thought I had secured it, but on careful examination found my net was empty and the moth had disappeared. While waiting to see if it would again appear it rose from the grass into which it had dropped, and, as usual, started off in a straight line of flight, but a second stroke netted it, and it proved to be a male in perfect condition, while in 1905 many specimens were ragged by the 15th. I hastened on to the old locality, expecting to find them flying there in numbers, but no more were seen. I went again on the 26th, though the evening was unfavourable, as it seemed to be the last likely opportunity, but none were seen.

In contradistinction to my lack of success at Montreal South, Mr. E. Denny and his son Arthur had great success in collecting the species at the Amherst Park locality, taking about seventy-five specimens, and also made the independent discovery of cast pupa-cases among the young willows. Mr. D. S. Kellicott was led from his observations to believe that *Hepialus Argenteomaculatus* which he found boring in *Alnus Incana* required three years to complete its transformations (Ent. Amer. I, 173, IV, 153, Insect Life I, 250). If these observations were correct, it would seem to be probable that *Thule* may also take three years to complete its

cycle, in which case another large flight of the species might not be due at the locality in Montreal South until 1908. As mentioned in a paper on specimens in the British Museum (CAN. ENT., XXXVII, 31), I found a specimen of *Thule* which had been in that collection since 1844, and which had been taken in the Hudson's Bay territory by George Barnston, proving that the species has a much wider distribution than had formerly been supposed.

Mr. Denny was led to seek the species this year by finding a specimen attracted to light, and there are a number of similar instances. The original type specimen must have been so attracted, as it was found, as mentioned in my former paper, in Phillips Square, the centre of the uptown retail business district, and several miles from its nearest possible breeding locality. The specimen secured by Mr. Bowles had also, evidently, been attracted to light, and Mr. Brainerd obtained one similarly attracted to Sherbrooke Street, in the fashionable residential district, and Mr. Gibson's specimen had also come to light, and I believe that attraction to light is the only thing which will cause them to fly after their usual time. Very few specimens, however, seem to be so attracted, as the above instances are all of which I have learned, and the places to look for the moth are where there is a good growth of willow scrub, and between 8 and 8.30 p.m. during the second and third weeks of July.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

The forty-fourth annual meeting of the Society was held in the Biological Building of the Ontario Agricultural College, Guelph, on Thursday, October 31st, and Friday, November 1st. The chair was taken by the President, Dr. James Fletcher, Entomologist and Botanist of the Dominion Experimental Farms. Among those present were Rev. Dr. Fyles, Levis, P. Q.; Mr. Henry H. Lyman, Montreal; Mr. Arthur Gibson, Central Experimental Farm, and Mr. C. H. Young, Ottawa; Dr. Brodie, Dr. E. M. Walker, Mr. J. B. Williams and Mr. C. W. Nash, Toronto; Mr. J. F. Calvert, Orangeville; Professors Hutt, McCready and Bethune, Messrs. Jarvis, Eastham, Howitt, Zavitz, Crow, Klinck, and a number of students of the Ontario Agricultural College; Mr. Howse, Principal of the Consolidated School, Mr. Graesser and others, Guelph.

The proceedings began on Thursday afternoon with a conference on Fruit-tree Insects. Mr. L. Caesar gave an account of the Bark-beetle (*Scolytus rugulosus*) attacking cherry-trees in the Niagara district; the

subject was discussed by Dr. Fletcher and Mr. Jarvis. The work of the Codling-worm and its ravages this year, the Oyster-shell scale, the Woolly Aphis, Flea-beetles and other insects were taken up and discussed by Dr. Fletcher, Dr. Brodie, Professors Hutt and Bethune, Messrs. Jarvis, Nash, Caesar, Crow, Frier and Thompson. The remainder of the afternoon was occupied with the reading of the reports of the Directors on the insects of the year in their respective districts.

In the evening MR. A. H. KIRKLAND, of Boston, who is in charge of the efforts now being made in Massachusetts to suppress the Gypsy and Brown-tail Moths, gave a highly-interesting account of the work and the results that have so far been accomplished. His address was illustrated with a series of lantern pictures, which graphically showed how the operations are carried on. He described also the importation of parasites and some predaceous beetles from Europe, and the amount of success which had so far attended their efforts to breed them. DR. FYLES followed with one of his charming papers, "The Voices of the Night." Much regret was expressed that the attendance was small owing to the attractions of the holiday.

During the second day, Friday, November 1st, meetings were held both morning and afternoon in the Entomological Lecture-room, and were well attended by the members and students. The reports of the Council, Officers and Branches of the Society were presented and read, and the following papers: "The Two-winged Flies of the Province of Quebec," by Dr. Fyles; "Further Notes on Hepialus thule at Montreal," by Mr. Lyman, and notes on the same insect by Mr. E. Denny, of Montreal; "Scale Insects of Ontario," illustrated by a large number of specimens, by Mr. Jarvis; "An Unusual Outbreak of Halisidota Caterpillars," by Mr. Gibson: "A Remarkable Outbreak of the Variegated Cutworm," by Prof. Bethune and Mr. Caesar; "The Entomological Record for 1907," by Dr. Fletcher. Papers by Dr. Fletcher and Prof. Bethune on the Insects of the Season, 1907, were not presented, owing to want of time. Dr. Fletcher closed the afternoon's proceedings with his Presidential address on "The Entomological Outlook in Canada."

In the evening a public meeting was held in Massey Hall, when an interesting address was given by DR. E. M. WALKER, of Toronto, on Collecting and Rearing Dragon-flies at the Georgian Bay Biological Station. A large number of beautiful lantern views were given in illustration of the lecture.

The election of officers for the ensuing year resulted as follows :

President—James Fletcher, LL.D., F. R. C. S., F. L. S., Entomologist and Botanist of the Experimental Farms, Ottawa.

Vice-President—Tennyson D. Jarvis, B. S. A., Lecturer in Entomology and Zoology, Ontario Agricultural College, Guelph.

Secretary—L. Caesar, B. A., O. A. College, Guelph.

Treasurer—S. B. McCready, B. A., Professor of Botany and Nature Study, O. A. College and Macdonald Institute, Guelph.

Librarian—Rev. C. J. S. Bethune, M. A., D. C. L., F. R. S. C., Professor of Entomology and Zoology, O. A. College, Guelph.

Curator—J. Eaton Howitt, B. S. A., Lecturer in Botany, O. A. College, Guelph.

Directors : Division No. 1—C. H. Young, Ottawa.
Division No. 2—C. E. Grant, Orillia.
Division No. 3—J. B. Williams, Toronto.
Division No. 4—C. W. Nash, Toronto.
Division No. 5—George E. Fisher, Burlington.
Division No. 6—J. A. Balkwill, London.

Auditors—B. Barlow, B. S., and J. Crow, B. S. A., Ontario Agricultural College, Guelph.

Editor of the "Canadian Entomologist"—Rev. Prof. Bethune, Guelph.

Editing Committee—Dr. Fletcher, Ottawa; H. H. Lyman, Montreal; J. D. Evans, Trenton ; Prof. Lochhead, Ste. Anne de Bellevue, P. Q.; G. E. Fisher, Burlington ; J. B. Williams and C. W. Nash, Toronto.

Delegate to the Royal Society--Arthur Gibson, Ottawa.

NOTES ON THE COLLECTING OF STHENOPIS (HEPIALUS) THULE.*

BY E. DENNY, MONTREAL.

Very little appears to have been written by entomologists on the above subject, and no doubt the cause is due to the conditions that surround the life habits of these mysterious moths. In the first place, there is a good deal of uncertainty as to the time of their flight or appearance. Secondly, the distance to be travelled to reach their haunts often means the loss of much valuable time to the collector ; and thirdly, the exceedingly short

*Read at the Annual Meeting of the Entomological Society of Ontario, Guelph, Nov. 1, 1907.

period of flight. These are the chief obstacles that present themselves to the collector whose ambition is to try and improve his knowledge by putting forth whatever energy he possesses. For the past two or three years I have been very anxious to find out something concerning the habits of this particularly interesting moth, which occurs for a period of a few days only, and with few exceptions for only a few minutes at a time at twilight. These moths are termed "Ghost Moths," and no doubt derived that name from their peculiar habit of flight, for just as it is getting dark they seem to appear of a sudden from no particular place, make a few erratic evolutions in the air, and disappear as suddenly as they appeared.

It was on the evening of the 16th of July, 1906, that my son Arthur had the good fortune to catch *Sthenopis thule* at light on Park Ave., Montreal. He had been collecting at the electric lights, and was about to return home when his attention was attracted by the peculiar flight of a moth, which in a few seconds settled in the road, and proved to be *Sthenopis thule.* We at once turned our attention to this particular moth, abandoning all other species for the time being. Previous to this we had discovered a new locality where *thule* could be found. Although personally I had never visited what is known as the old original hunting grounds known as Montreal West and South, but from information gained I was able to form a good idea of what the conditions were. I at once came to the conclusion that the locality referred to above, known as Amherst Park, was the right spot, being much nearer the city, and disposing of the uncertainty of catching the ferry boats, and it was to this locality that our efforts were directed. From the 16th to the 23rd of July this spot was visited regularly, the result being that 12 specimens in all were taken. This was not thought very encouraging considering the time and expense incurred in collecting them. The following year we visited this spot each night regularly from the 9th, but strange to say no *thule* was seen until July 16th, exactly the same date as our first capture the year before, but on this occasion three specimens were taken. The following night an expedition was arranged and we proceeded to invade the haunts of this mysterious moth. On this occasion the moths were very lively, and appeared to fly longer than usual. However, darkness soon put an end to the sport, and when the material was gone over it was found that 32 specimens had been captured. This I consider a good catch. The greatest number of these were males, and I attribute the

length of flight on this occasion to the absence of females, for it would appear they only fly long enough to find and select a partner, and mating takes place immediately. The next night an early start was made to search the bush before dark, our object being to try and find them before it was time for them to fly. This was successful also, for both imagoes and pupæ shells were secured, the former on the stems of the Willow, and the fresh pupæ shells on top of the ground. On this occasion, as on the following night, the flight was very short, and females were plentiful; 10 specimens were taken on the 18th, and on the 19th 18 specimens of *thule* and a fine specimen of *Sthenopis quadriguttatus* were added. A careful search of the bushes after dark gave us four pairs in copulation. This was something new to us also, and was taken advantage of the following night with good results, moths being secured before it was time for them to fly. July 19th and 21st were unfavourable for collecting, owing to wet weather. July 20th, however, eight specimens were taken, and on the 22nd four more were added, and this proved to be the last, for although the search was kept up, none were seen after that date. On that evening a number of Sphingidæ were seen at the Willow, and three or four specimens were taken. We were about to give up the pursuit on account of darkness, when we saw something hovering about the top of the bush, gradually working its way to the other side. By a quick turn and swing of the net my son managed to land it, and to our surprise it was a female *thule*. We had never seen one fly like this before. The dates of flight herein mentioned are somewhat late, but I attribute this to the unusually late spring and cool summer, and would be inclined to say that under anything like normal conditions their appearance would be from about July 8th to the 20th. The time of flight each night is on an average about fifteen minutes, and none were seen on the wing before 8 p.m., and not later than 8.30 p.m., with the exception of the specimen we have referred to taken at light.

Our efforts were well rewarded, for in all 75 specimens were taken, and a little information gained as to the habits of *Sthenopis thule*.

NOTE.—It was the unanimous opinion of those present at the meeting when this paper was read that such wholesale captures of this rare moth were most strongly to be deprecated. Collectors should be satisfied with a few specimens annually, and not run the risk of exterminating a most interesting species, which is only known to frequent a few very limited localities.—ED. C. E.

STUDIES IN THE GENUS INCISALIA.

BY JOHN H. COOK, ALBANY, N. Y.

When I began the investigation of these butterflies some years ago, four species referable to the genus *Incisalia* were known to occur in the eastern half of the continent, *irus*, *Henrici*, *augustus* and *niphon*. It was my aim to breed each from egg to imago, and by a careful comparative study to furnish the biological data which would enable anyone taking an active interest in the group to repeat the observations, verify and supplement the facts, and to correct any errors which I may have made. I hoped also by outlining the life-histories of these four species to furnish a basis for the proper study of the western representatives of the genus, a work which is reserved for that lepidopterist of the trans-Mississippi region who will one day arise to tell us something of the early stages of those species known to most of us in the east as dead and dried "specimens" only.

The fact that the species mentioned were the only members of the group which had been recognized in Eastern North America,* lent to the prospective success of the undertaking the added value of a comprehensive study of all the species found over a comparatively wide area.

Recently, however, a fifth species has been unearthed. It was described in the CANADIAN ENTOMOLOGIST for June, 1907 (p. 202), as *Incisalia polios*. The discovery of this butterfly within the territory which I had expected to cover made it necessary to work out its life-history or to forego that degree of completeness which I had planned for my review of the genus.

The memory of many days of failure preceding final success in other cases did not lend encouragement to the hope of securing the desired information and material during the brief stay which would be possible at the end of a two-hundred-mile journey, but as nothing can be accomplished without an effort, I determined to make the attempt.

Accordingly, arrangements were made to visit the type locality (Lakewood, N. J.) early in May, 1907, in company with Mr. Frank E. Watson, to whose work the recognition of this species was largely due, and Mr. Chas. H. Sunderland, of Rutherford, N. J., an ardent collector of lepidoptera.

*Unless the *arsace* of Boisduval and Leconte should prove to be entitled to specific distinction.

As it was possible for me to go to Lakewood before the others, Mr. Watson very kindly provided me with a detailed map of the region, showing the exact points where in previous years he had taken the species. I arrived about noon on the 3rd, and went immediately to the collecting ground. It had rained during the morning, and as clouds obscured the sun during the rest of the day, the vegetation remained wet; but despite the unfavourable weather I took three males and one female of the new species, and confined the last in a gauze bag over *Vaccinium corymbosum.* During the evening it began to rain again, and the downpour continued until 10.30 the next morning. The storm area then passed off to the east and the sun shone brightly, though a high wind marred the prospect of finding many butterflies about. The map enabled me to locate all points readily, and from what I knew of the congeners of *polios*, I felt confident that the insects would again be found frequenting the same sunny spots and flitting back and forth over the same restricted stretches of sandy road. Such proved to be the case, and before one o'clock I had captured a dozen or more. Of these one was a female, and I confined her over *Kalmia angustifolia.*

I had just taken another female when I was hailed by Mr. Watson and Mr. Sunderland, and in the excitement of pleasant greetings the butterfly was left a little too long in the stupefying bottle,* and did not recover. Our combined efforts for the rest of the afternoon resulted in the capture of several males and two females. Of the latter, one was confined over cranberry and the other over sand-myrtle, *Dendrium (Leiophyllum) buxifolium.*

The following day appeared to be ideal for butterfly collecting, but for some unexplained reason very few were on the wing. The female tied up on *corymbosum* had died during the night, and none of the survivors gave indications of a desire to oviposit. A hasty survey of the surrounding flora induced us to alter our plan, and each female was supplied with a variety of plants. Until the lengthening shadows put an

*In endeavouring to secure living females of species where the sex is not readily discoverable, I have found it of advantage to use a very weak cyanide bottle, from which the insect should be taken as soon as it loses the power of flight. If then, upon examination it proves to be of the desired sex, a few minutes in the air will usually suffice to restore it completely.

end to butterfly activities, we patrolled the roads, explored the underbrush or watched the imprisoned females, in an endeavour to gain some hint of the secret we had come to discover. Before evening we had managed to add four living females to our catch, but had observed nothing which narrowed the circle of probable food-plants, and thus the time to leave Lakewood found us no wiser than before.

On a purely theoretical basis it seemed likely that the food-plant would prove to be one of the *Ericaceæ* (the dominant family in that region of sand and bog), and, if so, probably some ericaceous species not found at Albany, since the butterfly does not occur here. Accepting this tenuous hypothesis for lack of a better guide, I brought home cranberry, sand-myrtle, laurel *(Kalmia latifolia)* and *Andromeda* sp. Mr. Watson took one female to New York, and kept her shut up with *Pyxidanthera barbulata* until she died, but secured no egg. Five of the other six reached Albany alive, and were put in a large "cage" with the plants brought from New Jersey, and a number of possibilities from the local flora.

The record for the next few days is mournful reading; it all belongs to the obituary column. The last of my females died on the 15th without having yielded ova, and I immediately wrote to Mr. Watson to meet me in Lakewood on the Saturday following. Meanwhile I dissected one of the butterflies, and was greatly pleased to discover that the eggs were very different from those of the congeneric species, and could be identified without difficulty.

I reached the Lakewood locality early in the afternoon of the 17th. The day was cold and cloudy, and not a butterfly was seen. I examined as much of the pyxie and sand-myrtle as was possible before nightfall, but my only reward was an aching back.

Saturday dawned clear, warm and delightful, and before 8.30 I was in the field awaiting the butterflies. *Brizo*, *troilus*, *philodice*, *comyntas*, *juvenalis* and *ladon* added to the pleasure of a typical May morning; *augustus* was abundant, and several *niphon* and one *irus* were taken, but *polios* had apparently disappeared for the season. I did capture one, but as it proved to be a male I released it. The prospect was discouraging, and there was nothing to be done but to continue the uncomfortable search for eggs. This I did religiously but without much heart all the afternoon.

Mr. Watson came down on the evening train, and I reported my lack of success. We held a council of war, and decided that, in view of the scarcity of *polios* in the local field, it would be wise to move our base of operations to Lakehurst, a few miles further south, where also the species was known to occur.

We boarded the 9.05 train the next morning, and reached Lakehurst at 9.20. Crossing the dam of the cranberry bog just north of the station, we started for the highway running back to Lakewood. A rod or two along the north edge of the bog we found two *polios* playing beside the path, and I sat down to watch them. Mr. Watson elected to go ahead. I soon concluded from the actions of the butterflies that they were unmated males, so turned my attention from them to the surrounding vegetation. There was no sand-myrtle to be seen, and I noticed only one small patch of pyxie. The butterflies were resting on leaves of bearberry (*Arctostaphylos uva-ursi*), to which they returned after short flights induced by touching them with a grass blade. Although this plant had not been observed at Lakewood nearer than a quarter of a mile from the road where the butterflies were taken, the fact that it was an ericaceous species suggested the advisability of looking it over. Oh, happy inspiration! On the pedicel of the very first flower examined there was an egg, echinoid and undoubtedly Lycænid. With a lens the sculpture could be made out, and I recognized it immediately as the egg of *polios*. Concealing my elation, I proceeded along the path in the direction taken by Mr. Watson, intending to give him a surprise. I was given one instead. He arose from a bed of *Arctostaphylos* with a shout of triumph, and handed me another *polios* egg which he had found at the base of the leaf-bud. This double discovery was made at 9.35, fifteen minutes after leaving the train.

Past disappointments were forgotten. We began a systematic search for the ova, and within an hour had collected ten more and an empty shell.

On the return journey another bearberry patch attracted attention, and we halted long enough to secure five more eggs. A female taken near-by was confined in a can under gauze with some young shoots, and generously added four eggs, bringing the total up to nineteen. Arrived at the Lakewood locality, we put aside our collecting outfits and carefully went over the ground, looking for the food-plant. It was not to be found. We then examined the bearberry nearer the village, in the vicinity of

which no *polios* were found this year (1907), though Mr. Watson had taken one or two the preceding spring. Not an egg was discovered,* and it would seem that—unless we overlooked a plant not at all difficult to find—the species has a second food-plant at present unknown.

Mr. Watson took a few of the ova, and succeeded in bringing one of the larvæ through all its changes. I brought the rest to Albany, and they all hatched between May 23rd and 28th. On the 24th sixteen eggs which had been collected at Lakehurst by Mr. William P. Comstock, were sent to me by Mr. Watson. In spite of the difficulty of obtaining fresh food (the nearest locality for bearberry known to me is some sixteen miles from here), and the consequent mortality among the caterpillars, a few lived to pupate, and the life-history is practically complete.

Not altogether satisfied with a laboratory knowledge of the larvæ, a third trip to New Jersey was made for the purpose of studying them in the field. June 29th found us at Lakewood once more, but a driving rain effectually prevented our doing anything during the morning. This had simmered down to a mere drizzle by lunch time, so, donning raincoats, we started to walk to Lakehurst. Comprehending our plan, the wily storm swung around and came tearing back with greater fury than before. As there was no shelter to be had along the railroad track, we were thoroughly drenched before reaching our destination. Purchasing some dry underclothing, we sought the bearberry locality, and after an hour's search discovered a full-grown caterpillar.

The next day was spent in the same region, and between showers we collected three more larvæ, all of which had passed the final moult. All of the four taken in the field appeared to be healthy, and pupated within a few days. If any were parasitized it will not be evident until next spring.

The above account is given principally to indicate the rather limited opportunities which the author has had for studying this species. The generalizations concerning feeding habits of the larvæ, etc., which will appear in a succeeding paper, are based upon the meagre data obtained during these three visits to New Jersey, and are subject to correction in the light of broader experience. The life-history of *polios* will be given in detail as soon as possible.

*Eggs were subsequently found in this patch by Mr. William P. Comstock, of New York City, the larvæ from which were bred to maturity by him.

NOTES ON HEMIPTERA.

BY G. W. KIRKALDY, HONOLULU, HAWAIIAN ISLANDS.

Fam. Geocoridæ.

1. *Stalagmostethus pandurus* (Scop) [= *Lygæus militaris*, Auct.].—India, Kangra Valley, 4,500 ft., July (Dudgeon).

2. *S. albomaculatus* (Goeze).—Hungary, Budapest (Burr).

3. *Arocatus æenescens*, Stal, 1874 = *Scopiastes Bergrothi*, Kirkaldy, 1903!

4. *Graptostethus servus* (Fabr.).—Queensland, Brisbane; 1 ♀.

5. *Cænocoris Dudgeoni*, Kirkaldy.—Distant declares this to be the same as *C. marginatus* (Thunb.), but I doubt it. What I suppose to be the nymph is blood-red. Eyes, antennæ, meso- and metanotum, femora, tibiæ and tarsi, the odoriferous flaps, last stemite, etc, blackish. Fore femora unarmed. Pronotum deeply impressed ovally down the middle. Tarsi all a little widened apically, and furnished with a pad.

6. *Pyrrhobaphus.*—Distant (1903, Faun. Ind., II, 14) says that the first segment of the antennæ nearly extends to the fore coxæ, but his figure 8 does not confirm this. In his "Synopsis of genera" (p. 3) delete "Orifices red or pale coloured" from *b*1.

Fam. Reduviidæ.

7. *Ptilocnemidia lemur* (Westw.)—Queensland, Brisbane.

Fam. Miridæ.

8. *Monalonion Peruvianum*, sp. nov.—Polished and shining. Head black, a curved line from near the insertion of one antenna to that of the other, via the base of the head, the under side of the head (except the clypeus), etc., reddish-yellow. Antennæ black, not pale at their insertions, 4th segment reddish. Rostrum yellow, more or less infuscate. Pronotum yellow, collar and the hind margin (widening medially) blackish. Scutellum and tegmina immaculate blackish, membrane and wings very dark smoky, veins concolorous, not polished. Sterna, coxæ and abdomen immaculate orange; rest of legs black, middle femora with a ferruginous ring near the base, hind femora with basal two-thirds pale (though the extreme base is blackish). Head nearly three times as wide as long, a trifle more than one-half of the width of the hind margin of the pronotum. Second, third and fourth segments of the antennæ shortly pilose, second more than five times as long as the first, about one-third longer than the third, and six times as long as the fourth (unless the latter is shrivelled).

Rostrum not reaching to the middle coxæ. Pronotum truncate behind. Tegmina with the lateral margins comparatively subparallel. Hind tibiæ straight, not pilose.

Length, 8 mill.; width, 2 mill.

Hab.: Peru, Callanga.

9. *Trimoncopeltus simulans* = *Lygdus simulans.*—Distant, 1883, B. C. A., Het., I, 242, Pl. 24, f. 16.

Hab.: Peru, Marpacalla.

Distant's figure and description are both poor. The sulcation of the head is of the feeblest kind; the pronotal callosities are well marked and contiguous, almost forming a second collar. The cuneal notch is not profound. There is no hamus in the wing-cell. The membrane is unicolorous, var. *atrior* nov. Tegmina black, except a long-triangular spot near the apex of the clavus interiorly, lateral margins of corium, basal two-thirds of cuneus, etc., whitish-yellow. Size and locality of the type-form as above.

Fam. Issidæ.

10. *Eurybrachys tomentosa* (Fabr.).—Malabar Coast, Mahe.

The hind femora and tibiæ are concolorous, sanguineous.

THE IDENTITY OF BREPHOS CALIFORNICUS AND B. MELANIS.

BY HARRISON G. DYAR, WASHINGTON, D. C.

Professor Smith attempts to identify these species with forms of *Leptarctia*, and states that his series is not sufficient to enable him to exactly match Boisduval's descriptions. The descriptions can be fairly well matched in specimens before me in the collection of the National Museum, *californicus* corresponding to a form that we have under typical *californiæ*, Walker; *melanis* to darker specimens of *dimidiata*, Stretch. As no two of the eighty specimens before me are alike, it seems scarcely necessary to insist on exactly matching the descriptions. In short, I see no objection to this identification, except the rather serious one that Boisduval, in the same publication in which he described the species of *Brephos*, also described the *Leptarctia*, three forms, as *Lithosia decia*, *L. lena* and *L. adnata*. Is it to be supposed that so good a Lepidopterist as Boisduval would describe the same species thrice as a Lithosian and twice as a *Brephos* in the same paper? Possibly so; but this seems doubtful, and it may be better to hold the *Brephos* names on our lists for a while, much as we should like to dispose of them in the way suggested by Professor Smith.

SYNELIS ENUCLEATA, GUEN.: A CORRECTION.

BY LOUIS B. PROUT, LONDON, ENGLAND.

My attention has been called to Mr. Swett's interesting article on this variable species (CAN. ENT., XXXIX, p. 141). With most of his conclusions I am in entire agreement; indeed, it was I who first called Mr. Taylor's attention to the fact that the name *alabastraria* (not "*alabastaria*"), Hübner, did not belong here at all. There has, unfortunately, been a misidentification of Guenée's type form, which necessitates a further revision. I cannot quite understand what gave Mr. Swett the impression that that author's description referred to the form with dark blotches on both wings, and as to the supposed "type" in M. Oberthür's collection, I may point out that Guenée described from "Six exempl. Coll. Mus. et Gn.," and was acquainted with all the three principal forms. But he describes as typical the form with the transverse *lines only* ("bordées de points noirs un peu oblongs" of course refers to the marginal spots), and distinctly includes in var. A. both the others—"tantôt deux taches à l'angle interne des supérieures seulement, tantôt une double série d'ombres séparées par une subterminale claire, mais ne montant jamais au-dessus de la 1'aux supérieures." As Mr. Swett says, he figures the intermediate form (var. *relevata*, Swett). The extreme form, therefore (*alabastaria*, Hulst, not Hübner, *enucleata* forma typica, Pack., et Swett, non Guen.), has never received a name, and as it seems to be considered worthy of having one, I propose to call it var. *adornata*, nov. I may add that the form *mensurata*, Walk., is not strictly typical, being of a purer white ground colour than the type; and those who wish to name *every* phase of aberration may add this to the list of separable ones.

Summarized, the synonymical results are:

Synelis enucleata, Guen., = *restrictata*, Walk., et Swett, = *reconditaria*, Walk. (fide Grote) = *continuaria*, Walk. (dirty yellowish-white, no blotches).

A. var. ("ab" in European nomenclature) *mensurata*, Walk. (purer white, no blotches).

B. var. (ab.) *relevata*, Swett, = var. A. Guen., *pars* = Guen., pl. xii, fig. 3 (blotches on fore wings only).

C. var. (ab.) *adornata* mihi, var. nov. = var. A. Guen., *pars* = *alabastaria*, Hulst non Hübner (blotches on all the wings).

MOSQUITO NOTES.—No. 5. (CONCLUDED.)

BY C. S. LUDLOW, WASHINGTON, D. C.

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This insect was described some months since, but by some error the MS. was not published as I expected, so I now use it as a conclusion to "Mosquito Notes, No. 5."

Ludlowia minima, n. sp.—Head light brown, covered with flat light yellow or yellowish-white scales, two brown bristles projecting forward between the eyes, a few brown fork scales in the nape; antennæ brown, verticels and pubescence brown, and normal; basal joint testaceous, with a few short brown hairs; second and third joints have a few flat brown scales; palpi brown, apical joints missing, those remaining heavily brown-scaled; proboscis brown, tip light; eyes brown; clypeus brown, with "frosty" tomentum.

Thorax: prothoracic lobes testaceous, with a few brown bristles; mesonotum dark brown, partly denuded, but the remaining scales on each insect are dark brown slender curved scales (not hairs) and a few dark brown bristles over the scutellum and wing joint; scutellum with dark brown slender curved scales and brown bristles; pleura light, with a couple of brown spots and a few white scales; metanotum dark brown.

Abdomen light, with dark brown scales and narrow ochraceous basal bands extending laterally as small basal light spots; venter mostly light-scaled.

Legs as a whole brown, but the colour changing with the direction of the light to a light brownish-gray; coxæ and trochanters light; femora dark dorsally, ventrally almost white, tiny apical light spots on femora and tibiæ, distally dark, the rest of the joints missing except on hind legs, where the ungues are simple and equal.

Wings clear, densely covered with brown scales, lateral scales broadly lanceolate, median broadly truncate, showing very little if any symmetry; spine-like scales on the costa. Cells not so markedly short as in *Chamberlainii*. First submarginal about 1/7 long, and nearly the same width as second posterior, both very narrow; stem of former not half as long as cell, and about a fourth shorter than that of second posterior; mid-cross-vein meets supernumerary, and is slightly longer; posterior cross-vein slightly shorter than mid, and about twice its own length distant. Length, 2.5 mm.

Male.—Is very like female; fork scales on nape more numerous; antennæ missing; palpi longer than proboscis and clubbed; ungues on fore and mid legs unequal, the larger uniserrate, the smaller simple and comparatively straight; hind legs missing. Wing-cells shorter in proportion, and the stems longer. Length, 3 mm.

Habitat, Carandaugan, Mindanas, Philippine Islands. Taken January 19, 1906.

Neither specimen is perfect, and the male especially is in bad shape, but there can be no reasonable doubt as to the genus, or that the species is new.

Described from one male and one female sent by Lieut. W. H. Duncan, Assistant Surgeon U. S. Army, with specimens of *Chamberlainii;* it is an extremely small mosquito, quite as small as *S. minuta*, Theob., or *S. Amesii*, Ludlow.

NOTES ON RECURVARIA GIBSONELLA, KEARF.

BY ARTHUR GIBSON, OTTAWA.

Early in May, 1905, I collected at Hull, Que., which is just across the Ottawa River from Ottawa, some very small larvæ, each one of which was enclosed within several leaves tied together at the tips of the branches of the common Juniper, *Juniperus communis*, L. From this material I reared three moths, which were submitted to Mr. W. D. Kearfott for examination. Deciding that they were new to science, he honoured me by describing them in the January, 1907, number of the CANADIAN ENTOMOLOGIST under the name of *Recurvaria Gibsonella.*

During the past season some further observations were made on the species. On April 27 I again visited the original locality, and found larvæ very abundant in their characteristic winter quarters. At that time of the year each larva was found in a small tube-like enclosure at the tips of the main branches and side twigs. As many as nine or ten leaves were drawn together and fastened strongly with silk, in the centre of which the nearly full-grown larva passed the winter. As these leaves are dead, or partly so, and discoloured, the hibernaculum is easily found after having once been seen.

In early May a number of localities at and adjacent to Ottawa, where the common Juniper is abundant, were visited, and in every instance larvæ were found in considerable numbers. The species is evidently a common one, and will doubtless be found in many places where the above plant is plentiful.

Many of the winter homes of the larvæ were examined, and in all the larva was found with the head towards the plant. On May 18th, which was the third warm spring day at Ottawa since about the middle of April, when we had two such days, I noticed that some of the larvæ had revived, eaten their way down through the bottom of their winter case, and were feeding on the nearest green leaves. The whole inside surface of a leaf was eaten, after which the larva attacked other leaves in the same way. During this period a considerable quantity of white silk was spun just beneath but touching the winter home. A few of the leaves were gathered together by the silk.

On June 19 some larvæ were still found by Mr. Kearfott and the writer, and one living pupa in the winter case. At this time it was difficult to see the work of the larvæ on account of the new growth of the plants.

Larvæ collected at the end of April all pupated in their winter quarters, and no fresh food was put in the jar. Moths began to emerge about the middle of June, and continued to issue for a few days. From other material collected later, the moths appeared on June 29 and July 6.

The mature larva is 5.5 mm. long at rest. The head is honey-yellow, shining, slightly bilobed, rather flattened in front; clypeus reaching two-thirds to vertex; mouth-parts and margins of clypeus tinged with lake-red; ocelli black; antennæ short and pale, hairs on face pale. Thoracic shield concolorous with head, shining, wider than head. Body without markings, cylindrical, segments rather deeply divided, colour pale orange, venter paler than dorsum. Tubercles shining, large for size of larva, but inconspicuous, only slightly darker than body. Setæ slender, pale, one hair from each tubercle, anal shield honey-yellow, shining, all the feet whitish; thoracic feet bearing black plates.

The species is single-brooded.

Hylotoma spiculata.—A Correction.—In the description of this species on page 308 of this magazine, the locality is given as Oak Creek Canon, New Mexico. I am indebted to Prof. T. D. A. Cockerell for pointing out that this should have read Oak Creek Canon, Arizona.

Alex. D. MacGillivray.

A FOSSIL TORTRICID MOTH.

BY T. D. A. COCKERELL, UNIVERSITY OF COLORADO.

Practically nothing is known of fossil Tortricidæ, or indeed of any group of Microlepidoptera in Tertiary times. No extinct Tortricid has been named, although Gravenhorst (1835) referred to the existence of one in Baltic amber, and Menge (1856) reported four larvæ, two pupæ and a moth, supposed to be Tortricids, from the same substance. In the Florissant shales moths are exceedingly rare, and usually not fit to describe; but a fairly good *Tortrix* (sens. lat.) found in the summer of 1907 deserves to be reported.

Tortrix Florissantana, n. sp.

♀.—Length of head and body, 14 mm.; head, 1 3/5 mm. wide, palpi robust, probably directed upwards, almost 2 mm. long; antennæ with minute dark dots at intervals; thorax 3⅔ mm. long, about 3 broad; wings probably striped along the veins, but the scaling appears to have been nearly all lost, except at the apex of hind wings, which are here much darkened; primaries 14 mm. long, the costa very strongly arched, so that the centre of the arch is about 2 mm. distant from the straight line between base and apex of wing; outer margin about 5 mm. long, with a gentle double curve, the concave part uppermost; apex obtuse; inner angle very obtuse, and close to tip of abdomen when the wings are folded backwards; lower margin about 10 mm. long.

Hind wing about 10⅓ mm. long, the apex considerably less than a right angle: frenulum distinct, of two strong bristles; a part of the venation of the hind wing is visible; what appears to be the fork between the media and cubitus is about 4 mm from tip of wing; the second cubitus and first anal are also seen, normally placed.

Florissant, Colorado, in the miocene shales, Station 14 *(W. P. Cockerell)*. The insect as preserved is pale yellowish-red; the wings are directed backwards, as in repose. The arched costa and gently curved outer margin, without any suggestion of a projecting point, indicate Tortricid rather than Pyralid affinities, and I think the family reference is reasonably safe. The generic term is of course used only in the old broad sense.

Mailed December 7th, 1907.

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